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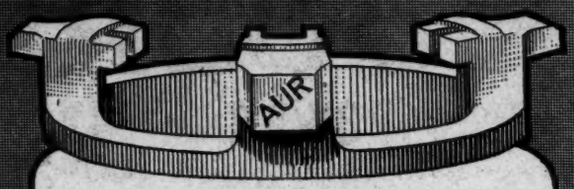

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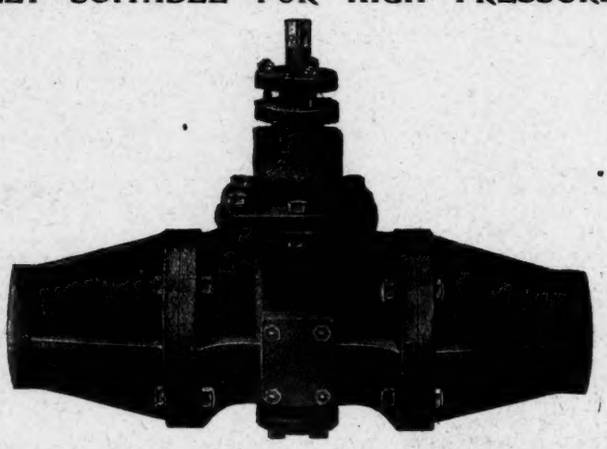

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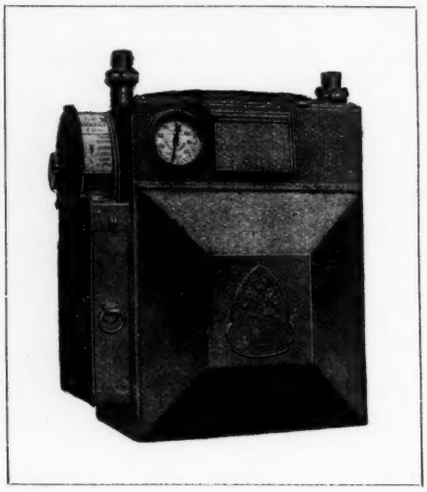

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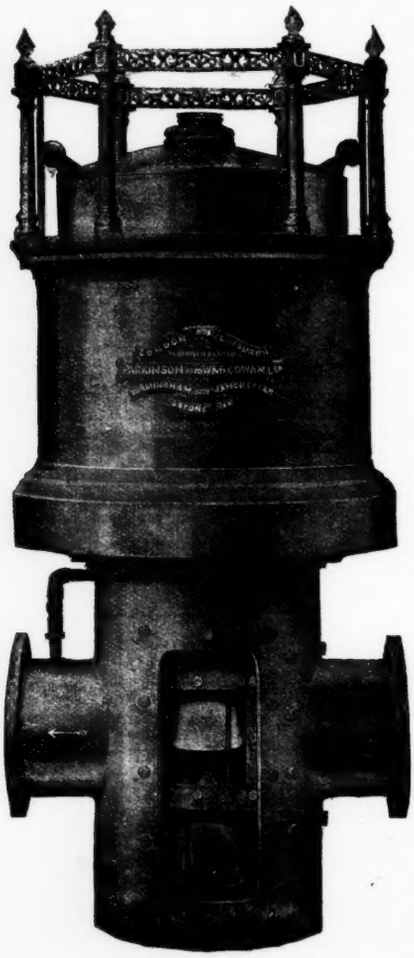

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[Founded in 1849 as the "Journal of Gas Lighting."]

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON, E.C. 4.

VOL. CXLIV., No. 2897.] TUESDAY, NOVEMBER 19, 1918. [70TH YEAR.

EDITORIAL NOTES.

End of Benzol and Toluol Control.

THE first step in the removal of control from the gas industry is taking place. The Ministry of Munitions is notifying the responsible managements of gas-works concerned that henceforth oil and tar washing for benzol and toluol recovery will be conducted entirely at their own discretion, and that no action will be taken in the event of their deciding to discontinue the process entirely, or to effect a reduced rate of recovery. We are in a position to add that it is likely the controlling power will be completely removed in the course of a few days. We cannot make this announcement without a word of acknowledgment as to the excellent relations that have existed between the *personnel* of the Explosives Supplies Department of the Ministry of Munitions and the gas industry. Primarily, the representatives of the industry have been brought into contact with Lord Moulton, Mr. F. L. Halford, and Mr. W. Doig Gibb. Their relations with them have been of the happiest and the most helpful; and through the whole piece, their efforts have been to assist the industry to carry out the work of recovery. There have been times when it was thought that more might be done. But if the industry has not always obtained all it desired, this has not been due to any want of sympathy or endeavour on the part of the gentlemen named. While working strenuously for the country in the hour of its need, they have not been unmindful of the difficulties of those with whom they have worked, and upon whom they so largely depended for supplies. Lord Moulton has from time to time thanked the industry, and made public acknowledgment of its services. The industry on its part thanks those in official position for the friendly spirit in which they have enabled the work required of the industry to be conducted.

Subsequent to receiving the communication on which the foregoing announcement is based, there was published in the "Daily Telegraph" a letter from Mr. Charles Carpenter, D.Sc., which we have reproduced on p. 431. We regret to see the letter, in view of the fact that the National Gas Council are, as the minutes (also published to-day) of the Executive Committee disclose, already in touch with the Board of Trade in connection with various problems with which the gas industry is brought face to face by the restoration of peace. The letter from the Chairman of the South Metropolitan Gas Company looks much as though there are (in view of what the National Gas Council are doing) divided counsels in the industry. While the Council are, we have understood anxious the industry should not be precipitated from one condition to another without a period of grace or without an effort being made to preserve for a time protection for the interests of the industry, Mr. Carpenter writes: "Now that an armistice has been signed, I urge that "these obligations should be withdrawn forthwith—at any "rate in the case of the Metropolis—so that the maximum "amount of heat and light energy can be placed at the dis-"posal of the public through the gas companies' mains." It seems to us that the only inference that can be drawn from this plea is that the gas industry has been supplying bad gas during the period it has been serving the country. Any falling-off there has been in the quality of gas has been due more to the coal supplies—quantitatively and qualitatively—than to oil or tar washing; and the South Metropolitan Gas Company themselves have done more tar washing than oil washing during the war, while the other Metropolitan Gas Companies have done more oil than tar washing. The repressive conditions in respect of coal supplies continue. Therein we have the weak spot in the producing position of the gas industry; while the washing of gas with oil for benzol recovery does not make more than 5 p.ct. difference in calorific value. The gas industry is entering on a fight for greater freedom. Mr. Carpenter's letter is a blow against the aspirations of the industry. Benzol recovery many desire shall be a recognized part of the future processes of industry. Mr. Carpenter suggests its displacement "so that the maximum "amount of heat and light energy can be placed at the disposal "of the public." We want nothing done that will prejudice the interests of the gas industry in the future in any action it takes to secure larger freedom. The local governing authorities not only in the Metropolitan area but in certain provincial centres assuredly need no encouragement to attack the gas industry; Mr. Carpenter's name, position, and letter have put in their possession something which they will not fail to use to the uttermost.

Peace and the Future.

THE torrent of outward display of joy, jubilation, and enthusiasm over the conclusion of an armistice which, it is believed, leaves no loophole for the interruption of the work of bringing Peace once more to a much battered and dislocated world, is subsiding; but the joy, jubilation, and enthusiasm aroused by the great victory of right over might, of justice over iniquity of the most callous, heinous, and criminal description, will abide in our hearts. Liberation from the great war, however, does not, while making us happier, permit the effects of the past four-and-a-half years' world upheaval and fearful destruction to be shaken off with the freedom that one with the will can change from an unpleasant scene to a more agreeable one. The termination of the war brings us at once face to face with great and heavy responsibilities—responsibilities arising from the war, and responsibilities of other order that must not be pushed aside, and the effects of which will reveal in the future the seriousness or otherwise with which they are now approached and handled. These responsibilities extend far and wide. They cover industry in every shape or form. Industry has to be rehabilitated; its war-altered courses have to be readjusted; new courses have to be formed; and industry in all its complicated nature and with all its multiplex purpose has to be put on the high road to fresh successes and larger prosperity by the liberal application of the lessons which the war has produced and has accentuated. These days when the armistice terms are (it is hoped) being faithfully carried out, and during the ones that will succeed when justice will see that reparation, so far as there can be reparation, is provided for and the Peace of the world is thoroughly safeguarded, will be days of transition for many industries, and the character of the transition must always be fully charged with constructive principles.

During the war we have been a nation very much alive; we have been obliged to put our several abilities and all the possessed potentiality to the utmost use. The gas industry has done a magnificent part, though under circumstances, which so far as they were controllable by war time hegemony, have been of the most discouraging. But having arrived at the end of the war, there is satisfaction that is supreme over discouragement in the fact that the industry has done its duty right well. It has grumbled; it has had good cause. But the grumbling did not bring much relief.

And the industry will not all at once realize emancipation from temporary rule and prescript. Let there be no illusion about that. There are some of the conditions under which it is working that apply for certain periods succeeding the termination of the war. What the periods mean is not stated exactly. The "Termination of the War Bill" deals with this matter. The general proposal is to carry out the recommendation of Mr. Justice Atkins's Committee that the date of the ratification of the Peace treaty should be the date of the termination of the war. But it has been found necessary to modify this in some respects, owing to the probability that the treaties with the different States with whom we have been at war will be ratified on different dates. Action is now, therefore, being taken to stop by Order certain powers before the date fixed.

The gas industry does not particularly want immediate relief from the work which has provided benzol and toluol and other materials for war purposes; they are commodities that will also be very much required by the country at large to help in rehabilitating its ordinary work and in establishing new production. Nor does the industry require relief from those conditions that mean for it manufacturing economy and efficiency and larger service. All it wants is that, as early as possible, its position in relation to coal and other material, to labour, to payment for its various products, and to finance generally shall be assured, and placed on a proper working and commercial footing. There must, however, be for all industries—it is unavoidable—a period of transition; we cannot spring from war conditions to peace conditions with express rapidity. The production of war material will not come to a sudden stop; it will ease-off gradually. The armies, the machinery, and the materials will be demobilized precisely as occasion and power permit—that is to say, there will be gradual liquidation, and the metamorphosis will be one long continuous panorama. We shall as a nation throw off our war garb systematically, and put on that of peace. By degrees there will be an infiltration of peace conditions into industry. That is the only possible and only safe course. There will still be Government control for a time; only as opportunity allows will its bonds be loosened until they finally disappear. Material will not be plentiful for long to come; there will still have to be priority and rationing until the great demand abates for restoration in Europe, and for new work, renewal, and repairs at home which have slid far in arrear. Only by measured pace will supplies at last reach a balance with demand. We cannot expect sudden conversion from an unprecedented abnormality to a new normality.

As already said, we have been a nation much alive during the war, and there has been brought to light and into contribution much dormant power. We have had lessons which have condemned us for past neglect; we have made good resolutions, and prepared big plans for the future. All these must not be lost. There must be no going back. What the Prime Minister says he is most in fear of is reaction and dissension. What the gas industry fears most is its compulsory reaction by Parliament or by the Private Bill Authorities, who will try to strip it of the economies that have been proved to be possible during war time, and compel it to recede to the prescriptions and the control of enactment that war time need, investigation, and experience have proved to be undesirable and incompatible with the new standards of requirement. Let us keep industry supple, says Mr. Lloyd George, and adapt it to the new conditions. The gas industry will be deeply grateful for all the assistance that can be granted to it to keep it supple, to adapt it to new conditions, and to prevent the success of the forces that would compel it to put on again its old harness. There is one thing for which the gas industry can lay upon itself a load of blame; and it is for allowing the electricity industry to make so considerable an impression on Parliament through inquiries carried out by men almost exclusively interested in the welfare of the electricity industry, without taking prompt measures to get simultaneous inquiry into the needs, potentiality, and conditions generally of the gas industry. A belated movement has been made; whether too belated is not at present certain. Anyway we sincerely hope not.

Meantime, the Fuel Research Board are to look into the question of economical gas production both from the manufacturers' and the consumers' points of view; the Gas Investigation Committee of the Institution of Gas Engineers and the Leeds University are at work; the Institution are having a report prepared which should show that the gas industry is the best conservator of coal that the country possesses, and that it produces from it a greater range of materials necessary to the country's welfare than any other industry. To compensate for the advantage the electricity industry has secured in impressing the authorities as to its great indispensability (although actually not so great as that of the gas industry), and that it should receive privileges and financial assistance of a preferential character, it should be the aim of the gas industry to set to work to get upon the most economical lines of gas production as quickly as possible, and to make the utmost out of the other products of coal carbonization, so as to supply the community with B.Th.U. on the best of competitive terms. The sooner and the more universally this is done, the better. With the gas industry by its new methods supplying a higher value than ever in heat units for a given expenditure on the part of the consumer, the grand reconstruction plans of the electricity industry will be matured under conditions somewhat different from those upon which they were planned. In this relation, while plant construction and reconstruction have been in abeyance in the gas industry, and there is much leeway to be made up, those engineers who are wise will fully consider their present requirements in the light of new experiences and the possibilities of the future in respect of the more economical production of gas—remembering all that has been unfolded to us during the latter months of the war in raising carbonizing efficiency by passing into the retorts aids to the realization of higher results.

We have come triumphant out of the war. Let us enter on a re-established peace in the same spirit of resoluteness that has enabled the Allies to win the war. If the men of the gas industry will do this, we are confident that all will be well, and that the industry will march into larger domains of service, and therefore prosperity, with all other industries that are working for progress.

Thermal Output in Gas.

THE old standards of working in gas manufacture look as though they are to be thrown overboard, and new ones adopted. We are now, for example, getting accustomed to refer to gas in terms of B.Th.U.; and several speakers and writers lately have been talking—in connection with steaming charges in vertical and horizontal retorts, and with mixing blue water gas with coal gas—of the total number of B.Th.U. (as well as the cubic feet) they put, in gaseous form, into their holders per ton of coal carbonized. In the steaming process, given suitable coal, it is seen that the workers are pushing up their makes to 20,000 c.ft.; and assuming the gas is of 500 B.Th.U. gross, the 20,000 c.ft. mean 10 million B.Th.U. It was seen in the article last week on Settle's "downward" steaming process for intermittent verticals that 10 million B.Th.U. per ton of coal is the standard output which is aimed at. This 10 million B.Th.U. would be a present ideal standard; but in quoting total B.Th.U. per ton of coal, it would be useful to know whenever possible the calorific value of the coal employed. It would give a new interest which would help to show the thermal efficiency of the gas-making process, leaving out of account the thermal value of the coke and of the other products made, although the time will doubtless come, as we get more scientific in the gas industry, when we shall also ascertain the thermal value of the coke produced as well as the thermal value of the gas, and shall deal, as a general rule, with total thermal efficiency. This will become more and more necessary as the utilization of coke reaches greater dimensions for steam-raising purposes, as those who purchase fuel largely for steam-raising are now doing so very generally on the calorific value and the ash and moisture content. But in regard to gas only, when we speak of (say) 10 million B.Th.U. being put into the holder, and the coal having a calorific value of (say) 13,500 B.Th.U. per pound, we can ascribe to the gas part of the process a 33 p.ct. thermal efficiency, which is an enormous figure compared with the showing of electrical stations; and the 33 p.ct. efficiency is without taking into account the value of the coke and other bye-products. Seeing that coal varies so much in quality, and that variations of quality naturally help to produce differences in the pounds of coal utilized for steam-raising for electricity generation, the proposal has been made that the B.Th.U. expended in producing a KW.-hour should be quoted. We should welcome the adoption of this suggestion, as it the more readily enables calculation to be made of the thermal efficiency of electricity generation, which is

now more or less cloaked by merely speaking of pounds of coal without citing its calorific value. Under extraordinarily fine conditions contributing to economical working, our "Electricity Memoranda" article to-day supplies an instance of an electric generating plant in America showing an efficiency of 17 p.ct., and this without economizers. An electricity plant that shows an efficiency on this side of 8 p.ct. is quite a rarity; 5 p.ct. is a nearer average; there are some bad instances showing something like an efficiency of only 1·5 p.ct.; and plenty of cases falling between this figure and 5 p.ct. The gas industry should talk about and demonstrate more than it has hitherto done the efficiency of its system. Its men have been too modest, or perhaps too indolent, to provide all the necessary data upon which the efficiency can be calculated. However, we are looking forward, now that we always talk in calorific value and not candle power, to the thermal efficiency of gas making receiving more prominence, and that constantly.

Liquid Purification and Related Topics.

WHILE the gas industry has many important problems that must receive immediate consideration, attention is being somewhat persistently directed to the now ancient subject of liquid purification, but by men of different training from those who, in years long since, occupied the platform in this particular. The new men are investigators in chemical and physical problems, with (in combination with their equipment in this direction) engineering ability. The causes of past failure with liquid purification have long been known. It has been the work of the more modern men to ascertain how to surmount these causes; and there is no certainty that they have successfully done so, or that the liquid purification process as a whole can ever hope to take any large practical part in the work of the gas industry. But, if it does, there is pretty positive assurance that it can only be an application by the larger works. One reason that has revived attention to the subject is found in the number of plants that have been erected for the production of concentrated ammoniacal liquor; and to suggest two possible ways in which this plant could be satisfactorily and suitably employed after the war was the primary purpose of the paper read by Mr. P. Parrish at the Southern District Association meeting last Thursday. We are much afraid that, in the relation of the mass of principles and laws governing liquid purification, the "primary "purpose" of the paper did not greatly impress the hearers, for it was entirely overlooked by the various speakers, and the discussion ran off more or less on to side-tracks of the subject.

Passing by laws and all the suggestions that Mr. Parrish makes for securing higher efficiencies in the process, one leaves the paper, the discussion, and the reply with the feeling that, while the process has been dressed in the best possible aspects, and it is very fascinating, practically and financially, there is at present insufficient in it to justify its adoption. The balance-sheet shows no sufficient additional credit to the process—despite all that has been done in raising heat and purification efficiencies and in reducing costs and the losses of ammonia—to warrant its acceptance in lieu of the present dry purification practice. Therefore, we are afraid that the employment of the plants that have been utilized in making concentrated ammoniacal liquor will find very little, if any, application in connection with liquid purification.

The ghastly failures of the past in this direction have been chiefly due to losses of ammonia; and we are afraid that, with all the circulating and recirculating work that has to be done, this loss will continue to be a fatal point. The fact, however, that 38·08 lbs. of ammonia, or over five times the quanity present in the gas from a ton of coal (seven times the quantity present is preferred to provide the necessary reserve), are required to effect the combination of the acid impurities in the crude gas per ton of coal, and the further fact that Mr. Parrish speaks of 80,000 gallons of liquor having to be dealt with per day for a 250-ton works, which, by the ability to obtain a concentration of about 6 p.ct. of ammonia, by the use of the dissociating and distilling plant he recommends, can be brought down to about 19,000 gallons as the amount to be distilled, are not points which would in any way shake our faith in the ultimate success of liquid purification under suitable conditions. But it has to be remembered that the efficiencies that are spoken about, and all the operating detail producing them, are the work of men of specialized training and qualification, and to reproduce in day-by-day working what they have been able to achieve would need supervisors having like accomplishments; and other than in large works this is too much to expect. We should want to see the cost of this reflected in reduced running expense and increased purification efficiency. But what is the nature of the promise? In the reply to the discussion, Mr. Parrish said he calculated that the capital cost of the plant will be no more than would be that for a series of purifiers for dry purification. Thus in the initial stage there is no advantage, excepting in one respect, that less ground space is required. But, on the other hand, it can well be imagined that the upkeep of the liquid purification plant, with its pumps and other accessories, would be more than that of a set of ordinary purifiers. Then again, in his reply, Mr. Parrish indicated that there was very little difference in the cost of liquid purification and solid purification. In this respect, therefore, there is no advantage. But this needs to be qualified. The purification is more complete; the efficiency in the removal of sulphuretted hydrogen is good; and the elimination of the carbonic acid is assured. The latter fact is not so important is these days of calorific value and not candle power. But there must be the exercise of the greatest care to ensure there is no escape of sulphuretted hydrogen into the district. Mr. Thomas Glover, for instance, is convinced that he would be far more comfortable with a liquid purification plant if succeeding it there were the ordinary dry purifiers. It is the necessity for competent and exacting supervision that puts liquid purification out of the realm of practical politics for most gas-works. Thus it is seen that assurance as to the possibility of avoiding ammonia losses is not satisfied; there are no advantages in cost so far presented of an order to make liquid purification an attractive proposition; but there are uncertainties as to efficiency unless there be rigorous control.

Owing to the length of the paper, Mr. Parrish had to deal in a very cursory manner with the second part of his subject, on the simultaneous recovery of ammonia and sulphur. As a matter of fact, he simply confined himself to a reference to the Burkheiser process. But it will be seen in the discussion that Mr. P. G. G. Moon, with his experience of the process at Bournemouth, was able to challenge the reasons that were put forward by Mr. Parrish for the non-success of the system. It will be observed, however, that before "non-success," the qualifying word "original" was used. From the information Mr. Moon advanced, it seems fairly certain that the reasons for "original" non-success have no practical existence now, but that the failure at Bournemouth was due wholly to the inability to obtain oxide of the proper physical characteristics. There has, however, been no abandonment of hope that success will be achieved by other means. Dr. Colman also called attention to the omission from the paper of any mention of the Feld polythionate process.

Opportunity was also taken by Dr. Colman, through an incidental reference to hydrocyanic acid in the paper, to warn gas engineers against accepting the view of Dr. Lessing that the oxide found in their mains, services, and meters is necessarily material carried forward by the gas from the purifiers. The facts that Dr. Colman presented in the discussion give good warrant for saying that, generally speaking, the oxides found in meter deposits are due to the insidious action of hydrocyanic acid in the gas, the removal of which it would be a very economical thing to secure from the point of view of plant deterioration alone. In this opinion, Mr. Parrish and Dr. Lessing thoroughly concur.

From Darkness to Light.

Within an hour of the time at which the armistice came into force, the authorities had promulgated a notice withdrawing the regulations which have put the country at night time under a pall, and which has caused the streets in the hours of darkness to be abandoned to a very large extent. Street lights that have been obscured were allowed as from Monday last week to be unmasked, shop window lights that have been shaded were permitted to be uncovered, and private houses were released from the obligation of drawing their blinds. There was no reluctance in taking advantage at once of the new freedom; and since then day by day London, provincial cities and towns, and places of less importance have been as busy as limited labour would allow removing the habiliments of gloom, and giving the streets at night time a more cheerful aspect. A journey through London streets the other evening showed a remarkable change. Though the Coal Controller, through the shortage of coal, is now the only light

controller, and will not permit the lamps that have been totally disused during the war to be brought into use now, the streets with even illumination considerably modified from pre-war times looked full of light, as they were full of life in view of the demonstrations of rejoicing over the victorious issue of the war. It was a good thing there had been this release of street and shop lighting, as there was an exuberance of spirits abroad which made light necessary for exercising an amount of judicious control in order to ensure public comfort and safety. We hope that with coal miners returning, and the opening of the seas again, there will soon be some relief in the coal situation; and then the inaugural work of restoring better night conditions to the streets will be further advanced before very long.

Less Munition Work and the Gas Equivalent.

The end of the war has released a large consumption of gas for munition purposes; and therefore gas-works being equipped and ordered for meeting such supply, there is good reason for the Coal Controller giving consideration to an enlargement of the gas equivalent per ton of coal under the Fuel and Lighting Rationing Order. He has practically admitted that the gas industry has a good case for a higher equivalent; but his reason hitherto for declining to increase it has been that he could not in the condition of coal supplies advance it, or make any gas allowance for the coke and other bye-products resulting from the carbonization of the coal at gas-works. The position is altered now. Much less gas and coke will be required for munitions production; and we can see many gas undertakings heavily injured financially—and goodness knows the war has harmed them severely enough already—if Sir Guy Calthrop maintains the same inflexible attitude over this matter of the gas equivalent. He knows full well that the 800 units per ton allowed to the electricity industry represents an extraordinary leniency which does not fit his plea of being hard-pushed for coal, and that gas is not the only fuel produced by the carbonization of coal at gas-works. The least that should be done now is to make the gas equivalent 20,000 c.ft. It will be seen by the notes from the National Gas Council in this issue that the Executive Committee are again approaching Sir Guy.

The Quality of Gas.

It is well to hear both sides of a question, and to give consideration to the arguments advanced by both before coming to a determination. The contributor of an article published in another column gives the low calorific power advocates something about which to think and discuss, and himself urges the supply of a gas of about 550 B.Th.U. gross, primarily on capital and plant grounds, and secondarily on time grounds in connection with use. We are strongly against extremes; but practical experience cannot be ignored when dealing with this subject. We have stood for the supply of a gas as clean as possible, and containing as low a percentage of incombustible gases as can be realized. Given such a gas, testimony from several quarters now shows that with a gas of about 450 B.Th.U. gross, the complaints of consumers (including power users) have diminished; there have been no difficulties with overloaded plant and meters; and there has been no increase in consumers' consumption. The lower-grade gas has enabled a larger production in gaseous form of B.Th.U. per ton of coal; and the financial position of the undertakings has been improved—to the advantage of the consumers—by the reduced coal consumption, and the increased quantity of gas available for sale per ton of coal. In several cases this year, increase of price has been averted where there has been steaming of charges, and more B.Th.U. produced per ton of coal, and satisfaction has been given though the calorific value per cubic foot of gas has been well below 500 B.Th.U. and nearer 450. Both steaming of charges and the use of blue water gas come in here. All this experience has to be fully controverted as being erroneous before any dogmatic attitude can be taken up or accepted. The experience should be thoroughly investigated. There is much with which we agree in our contributor's article; but, on the other hand, we are not prepared to dismiss as worthless the experience related by several responsible gas men.

Coke-Oven Managers' Association (Midland Section).—The first meeting of the session will be held at the Grand Hotel, Sheffield, next Saturday afternoon, when the Chairman (Mr. J. A. Wilson, of Staveley) will deliver his Inaugural Address.

OBITUARY.

Mr. W. T. Buckland, the Gas Engineer to the Chesterfield Gas and Water Board, whose wife died a few weeks ago, has had the further misfortune to lose his youngest son, Mr. LESLIE GERALD BUCKLAND, who was Analytical Chemist to the Staveley Coal and Iron Company. Taken ill with influenza, bronchitis and pneumonia supervened; and he died from heart disease.

Lance-Corporal OLIVER C. WALL, age 23 (the eldest son of Mr. H. Cromwell Wall, of Messrs. Biggs, Wall, & Co.), who was on active service in France, in the Tank Corps, was admitted into hospital at Camiers suffering from influenza, and died on the 22nd ult., after three days' illness. He was buried with military honours at Etaples. Mr. Cromwell Wall has two other a son-in-law on active service with the forces abroad.

The death occurred, on the 3rd ult., of Herr GEORG SCHIMMING, the Manager of the Berlin Corporation Gas Undertaking. He had apparently almost recovered from a prolonged illness, and hoped to resume his duties in a few weeks' time, when his death suddenly took place. He had attained the age of 59. He was in particular responsible for the largest of the gas-works (Tegel) which supply Berlin; but according to the testimony of his colleagues, the stamp of his leadership may be clearly seen in the development of all the Berlin Corporation Gas-Works during the last two decades.

The death occured suddenly on the 11th inst., at his residence at Limpsfield, Surrey, of Mr. JOHN EWART, who was elected a Director of the South Metropolitan Gas Company as long ago as December, 1888. He was, in fact, the last surviving member of the Board under whose administration the profit-sharing (later the co-partnership) system was established. Mr. Ewart was also on the Board of the Gas Lighting Improvement Company, Ltd., and was for many years a member of the Merchant Taylors' Company, of which he had been Master. He was 71 years of age. Among those present at the funeral last Thursday, at Oxted Church, were the Chairman of the South Metropolitan Company (Mr. Charles Carpenter, D.Sc.) and the Secretary (Mr. F. M'Leod). Several City friends also attended.

PERSONAL.

Dr. EMIL OTT, the Chemist to the Zürich Gas-Works, has been appointed to a Lectureship on the Gas Industry at the Federal Technical College at Zürich.

Mr. R. SCOTT, of Kilmalcolm, has been appointed to succeed Mr. W. H. Roberts (who has resigned) as Gas Manager to the Newtownards Urban District Council Gas-Works.

The Court of Assistants of the Salters' Company have appointed Mr. MARTIN O. FORSTER, F.R.S., D.Sc. (Lond.), to be the first Director of the Salters' Institute of Industrial Chemistry.

Sir HALLEWELL ROGERS has been re-elected Chairman of the Birmingham Corporation Gas Committee. He has also been nominated as Unionist parliamentary candidate for the Moseley Division of Birmingham.

Mr. P. PARRISH, of the South Metropolitan Gas Company, whose paper read before the Southern District Association of Gas Engineers last Thursday appears in this issue, has recently been elected an Associate of the Institute of Chemistry.

When leaving Halifax to take up the position of Works Superintendent to the Cleethorpes Gas Company, Mr. W. STANLEY CARPENTER was presented by the Manager (Mr. W. B. M'Lusky), on behalf of the staff and workmen, with a silver cigarette case, suitably inscribed.

Mr. C. VALON BENNETT, the Engineer and General Manager of the Rochester, Chatham, and Gillingham Gas Company, has, in addition to the positions he now occupies, been appointed Secretary—thus filling the vacancy caused by the death of Mr. W. H. Day. Mr. W. N. BROADBRIDGE, who has served the Company for a number of years as Chief Clerk, has been appointed Assistant Secretary; and Mr. H. GAGE, Superintendent of the Company's Gillingham station, has been promoted to the position of Assistant Manager to the undertaking.

At a meeting of the Hereford City Council last Tuesday, Mr. ARTHUR ROBERTS was appointed Gas Engineer and Manager, in succession to the late Lieut. C. V. Townsend, who fell in action on March 21, 1916. Mr. Roberts is a native of Hereford, and was an articled pupil in gas engineering under Mr. W. W. Townsend—a former Engineer and Manager at Hereford, and now of Colchester. For some years Mr. Roberts has been connected with the Hereford Gas-Works. In 1913, he was appointed Assistant Engineer and Manager; and from September, 1914 (at which time the late Lieut. Townsend joined the Army), he has been engaged as Acting Engineer and Manager. Since he took charge of the gas undertaking, the annual make has increased from 160 to 180 millions, and many improvements have been effected. In 1915, a new compressing station was erected, and additional compressing plant was put down. Last year, electrically-driven stoking machinery was installed; and contracts have been placed for a complete telpher plant, and a second coal-conveyor. Mr. Roberts holds the City and Guilds of London certificates in "Gas Manufacture" and "Gas Supply."

NATIONAL GAS COUNCIL.

Proceedings of the Executive Committee.

AN Emergency Meeting of the Executive Committee of the National Gas Council was held last Thursday, to consider the problems facing the industry as a result of the signing of the armistice and the approach of peace conditions—especially the Orders under the Defence of the Realm Act at present affecting the gas industry.

The financial position of the industry in connection with the reconstruction period, and thereafter, was considered; and the Chairman was asked to seek an interview with the Board of Trade on the whole future financial prospects of the industry.

It was reported that a communication had been sent to the Controller of Coal Mines regarding the Gas-Coke Prices Order, 1918, asking whether the Order is actually in operation and, if so, whether he would grant an interview to representatives of the Council and of Lancashire gas undertakings, who wish to state a case for the revision of some clauses of the Order so that the serious financial hardships inflicted upon gas undertakings in certain districts may be removed.

Resolutions from District Institutions of Gas Engineers were submitted, relating to the necessity for increasing the gas equivalent per ton of coal under the Household Fuel and Lighting Order. In view of the immediate reduction of work at munition factories, the large decrease in the output of gas already consequent upon the operation of the Order, and the anticipated early return of miners from the army, it was decided that the Coal Controller should be asked to take steps at an early date to relax the restrictions imposed upon gas consumption by the Order—especially in view of the fact that, if existing conditions persist, most gas undertakings must further raise the price of gas.

The difficulty of obtaining priority certificates for necessary tools, appliances, and parts required for repairs to machinery for gas-works purposes, was discussed; and it was arranged that a representative of the Council should approach the Priority Authorities in the matter.

ELECTRICITY SUPPLY MEMORANDA.

THE "Electrical Times" is giving the electricity supply industry something about which to think in descriptive articles they are publishing under the heading of "Isolated Electricity Plants."

Ten Thousand Tons of Coke.

The first one deals with Harrod's Stores, where the requirements for steam, hot water, and electricity, are of a very considerable order. Here is a huge establishment surrounded by public electricity supply cables, but the owners of the cables cannot, through the diversity of the demand on the establishment's boiler plant, compete with the private electricity generating plant—indeed, it is the diversity and largeness of the demand made upon the plant that render it economical for the company to be their own steam, hot water, and electricity generators; and the electricity is needed not only for extensive lighting, but for the lifts, conveyors, vehicles, and other mechanical operations. It is admitted by our contemporary that even a super-station would find the circumstances of an establishment of this kind a difficult nut to crack when it came to a question of competition. But the point of the whole article which interests us most is that it is stated that 10,000 tons of "fuel" are used by this one plant per annum; while the electricity demand is about 2 million KW.-hours. This, of course, does not mean that 11½ lbs. of fuel are consumed per unit of electrical energy generated, seeing that the steam plant has other demands upon it. The Engineer (Mr. Howes), it is said, keeps the steam plant in good fettle. But the use of the word "fuel" is interesting. It is excellent camouflage. It hides the fact that the fuel used is gas coke—"fuel" supplied by the strongest competitors of the electricity supply industry. And Harrod's have been patrons of coke right away from the time that the London Coke Sales Committee was established, now several years ago, and before the world-racked years through which we have been passing. If Harrod's have been using coke at the rate of 10,000 tons a year, then they have consumed 50,000 tons during the last five years, or the coke product of some 100,000 tons of coal. That they are continuing its use shows satisfaction. So it is seen that if these large isolated electricity generating plants are driven by steam, gas-works can supply the coke for fuel; if by internal combustion engines, gas-works can supply the gas or fuel oils for them. There are other universal providers besides Harrod's, Whiteley's, and such-like famous trading houses.

The Partial Release of Public Lighting.

There will be an amount of gratification in the electricity industry over the partial release of street and shop lighting from the restrictions and regulations that have been in operation during the war. Owing, however, to the coal shortage, street lamps that have been out of action will not yet be re-established; but there may be a certainty that the fullest possible use will be made of the relaxation that the end of the war permits both by shopkeepers and the electricity concerns, as the former are anxious to display their goods; and the latter are equally anxious to sell full-priced lighting units. In street lighting by electricity, there has been quite a terrible waste of current through obscuring the arc lamp globes. The consumption has been as heavy as usual. But the concentrated light of the arc lamps has necessitated a heavy coating of the globes, and this has little more than enabled at night time the location of the lamps to be visible. In order to save current, however, there has been a fairly large turnover from arc lamps to gas-filled ones of lower consumption and illuminating power. The effect of these is being seen now that the outer globes are cleared from the obscuring wash. It is evident that if these lamps are to remain permanently, they will have to be duplicated, or lamps of larger power substituted, as in the wide main roads, they give but a dim light from their high altitudes at the place where the light is most wanted. We will not grumble, in the hour of partial liberation from outer darkness, over the crude methods adopted in trying to disguise the streets at night time. We have learned something as to effect; and we have also learned that a uniform distribution of light is better from all points of consideration, when protection from aerial attack is the object, than the first attempts at street obliteration which took place on the initiative of unscientific, though all-powerful, authority. Should the occasion require—we hope it will never be again—the experience during the war will serve to bring about a more sober and effective treatment. But there is the immediate future. We do hope the authorities will not again allow the lavish waste in lighting that there formerly was purely for advertisement purposes, with a merciless inconsideration for the eyesight of people using the streets, and no regard whatever for satety, which is not promoted by alternations of glare and less but sufficient lighting. Electrical engineers have not cared about this, providing that they can swell the sale of electrical energy at top prices. Out of the war experience, it is hoped that something more scientific will issue in the matter of street and shop lighting. We had got into a chaotic condition before in this connection. But the war with relentless insistence put a stop to it all; and it is a sincere wish that from now reformation to a better ordered condition of things will be marked.

Minimum Charges and Maximum Resentment.

The compromise between consumers' discontent and legal powers in relation to minimum charges by electricity undertakings which the Coal Controller recently announced, and upon which comment was made last week, appears to have come as a "bolt from the blue" upon electricity undertakings. This is not exactly what the published announcement led people to understand. It was stated that the concession to electrical consumers' indignation at being charged a minimum when asked by the Coal Controller to economize electricity had been arranged with the electrical undertakings. But now it is stated by the "Electrical Review" that many of the managements of the undertakings did not know anything of the matter until they read the Coal Controller's notification in the daily papers. "Electrical Industries" also intimates that even the representative organizations had not been informed or consulted. The same paper states that the acceptance of the Coal Controller's prescription as to the reduced minimum charge is quite optional on the part of the undertakings; while the "Review," leaning towards this view, "sits on the fence," and declines to express a positive opinion. This is rather wise. But to put the matter to the test, and pick a quarrel with their small consumers, those undertakings who dissent from Sir Guy Calthrop's interference should make the minimum charge in the next bills on the statutory scale. and then see what will happen. The "Review" has been peering into "D.O.R.A.," and cannot find anything that confers upon the Coal Controller the right to intervene in matters of this kind. But it is only a natural consequence of his powers to ration, and to insist upon economy. The gas industry has had to submit to many things not specifically mentioned in "D.O.R.A." But the Government War Departments know how far they can go in these matters; and no good has yet resulted from challenging their prerogative. Under the Statutory Undertakings (Temporary Increase of Charges) Act, applications for powers of increased charge for electricity are being granted only subject to the minimum charge being waived; and this is an indication of what are the views of the Government Departments. Anyway, if the Coal Controller's compromise is not accepted by the undertakings, there will be a fresh outburst in the House and the Press, and the Coal Controller's Department will again be bombarded by dissatisfied consumers. The best thing for the electricity undertakings to do is to bow to the Coal Controller's decision; for it should not be a great while now before war-imposed regulations cease to exist.

Voltage and Lighting Efficiency.

The old question of the most economical voltage is constantly being revived. The 200 to 250 volt pressure in this country was adopted as a matter of economy to the electricity supply undertakings. But the voltage is against the interest of the consumers of electrical energy for lighting. Compared with 100 to 130 voltages, there is not only a loss of lamp efficiency, but an increased cost. Mr. F. W. Willcox has pointed this out by some comparative tables in the "Electrical Review," which show the conditions in this regard in the United States and in this country. His figures indicate

that in America there is from 12 to 21 p.ct. extra light output in favour of 110-volt vacuum lamps over the 220-volt ones, and from 5 to 18 p.ct. in the gas-filled ones. There is a difference in list price in favour of 110-volt lamps of from 14·3 p.ct. to 17·6 p.ct., and in the gas-filled type of from 8·3 p.ct. to 16·7 p.ct. In this country the extra light output in favour of 110-volt vacuum lamps is from 3 p.ct. to 11 p.ct., and of gas-filled lamps from 8 p.ct. to 16 p.ct. The difference in list price in favour of 110-volt lamps of the 30 and 60 watt size is 14·3 p.ct.; and for the 300-watt gas-filled lamps, 16·6 p.ct. There is no difference in this respect in the other sizes. The relative greater percentage gain in efficiency for America in the 100-volt over 200-volt lamps is due to the additional attention paid there to advancing the efficiency of such lamps. Mr. Willcox estimates that, on the average, the adoption of the higher voltages (200 to 250 volts) sacrifices 10 p.ct. in lamp efficiency and electric lighting service as compared with the 100 to 125 volt service.

Generating Efficiency.

What is the proper way of expressing the fuel consumption per unit of output of steam-driven electricity stations? We generally speak of so many pounds of fuel per KW.-hour of output, which is an altogether different thing, of course, from the KW.-hour delivered to, and paid for by, the electricity consumer, as it does not take into account the losses. But coal varies so considerably in calorific value, ash, and moisture that any reliable comparison is almost impossible. A better plan probably is to state the expenditure of B.Th.U. per unit of output. Here again the calorific value is not everything. The calorific value of a coal containing a high percentage of inert material may be as high as that of a material containing a low percentage of inerts; but by a cleaner coal a better duty can in working be obtained from the furnaces and boilers than with the former. Quite as good as stating the B.Th.U. expended would be to mention the pounds of coal utilized, if at the same time the calorific value was indicated. The point as to expression of fuel use in B.Th.U. is made by Mr. Alex. Dow in a paper read before the American Electro-Chemical Society, in which he produces the remarkable high efficiency figures for the Connor's Creek plant—figures which show an approximation to 20,000 B.Th.U. as the fuel use per KW.-hour. The load factor is, however, of a far different order from anything experienced in this country; and the fuel consumption has no likeness in lowness in this country, not even by the North of England plants that can boast the lowest fuel use. Take Mr. Dow's figures for the twelve months to June, 1916 (when the load factor was 40·9), the quantity of coal used per KW.-hour was 1·44 lbs., or 19,700 B.Th.U., showing that the coal averaged 13,680 B.Th.U. per lb. For the twelve months to June, 1917, with a load factor of 47·8, the consumption of coal was 1·52 lbs., or 20,040 B.Th.U., per KW.-hour, which shows 13,184 B.Th.U. as the calorific value per pound of coal. The 20,000 B.Th.U. per KW.-hour shows an efficiency of upwards of 17 p.ct. But let us look at some of the figures nearer home. With coal of a calorific value of 13,500 B.Th.U., if we take an undertaking using 5·5 lbs. of coal per unit generated, the efficiency is only about 4·6 p.ct.; taking a bad station using 10 lbs. of coal, the efficiency is only about 2·53 p.ct.; or the bad ones in Shropshire at the top end of the scale using some 17 lbs. of coal, the efficiency is only about 1·5 p.ct. The contrast with the Connor's Creek figures is notable.

THE QUALITY OF GAS: A FEW POINTS FOR CONSIDERATION.

[By a Correspondent.]

There is no more important question for the gas industry to settle than the much-discussed matter of the quality of the gas to be supplied in future. The writer of this article is one of those who consider that in a great many cases the lemon is being unduly squeezed in such a manner as will bring gas interests generally into disrepute. It is no light matter to reduce the quality of pre-war gas to the extent of 20 to 30 p.ct. Many are doing this to dodge the sliding-scale, and make a pretence of selling gas to the public at a lower price than would be necessary were the quality maintained—due allowance being made for the benzol and toluol extracted.

It is easy to take the line of least resistance, especially under war conditions. When plant has been neglected, and retorts and fittings are out of repair and leaky, nothing but an undue use of the exhauster will save the loss of the rich gas given off during the early stages of the charges. This practice, so commonly followed, is the chief cause of a high percentage of inert gases. In other words, the fault is due to bad management in the retort-house. It is no good blinking at facts. Those who are watering the milk in this way are the worst enemies of the gas industry, whose good name is thereby being sacrificed. No good and reliable business has ever been built up on a shoddy product, varying in quality from day to day, and diluted with an undue percentage of a useless constituent. Many immense fortunes have, however, been made on a carefully manufactured pure and unvarying product, which the public have learnt to trust. Would Bovril and Pears' soap maintain their business and their dividends were they to dilute their well-known products with refuse of one sort or another? They might do so for a year or so, but not for long; and thus it will be with those gas undertakings that are playing fast and loose with their customers.

What should be the gas of the future? The writer suggests that it should be of good quality, of approximately 550 B.Th.U. gross, varying in calorific power, in its constituents, in its specific gravity, and in the air required for its combustion from day to day and from hour to hour within narrow limits—say, not more than 7½ p.ct., and one which can be sold per B.Th.U. at the lowest possible price. Further, it should be freed from naphthalene, ammonia, and hydrocyanic acid, and with its inert constituents limited to (say) 12 p.ct. Are not those on the wrong track who are glibly assuming that gas of 450, 400, and 350 B.Th.U. is going to be sold at a price which will show an advantage to the public? Have they fully considered that their foul mains, exhausters, condensers, scrubbers, purifiers, station meters, gasholders, boosters, district mains, services, meters, and the other expensive plant which go to make up a gas undertaking's property, must vary in size according to the volume of gas to be dealt with? If the plant has been designed for 550 B.Th.U. gas, and we wish to supply 400 B.Th.U. gas, and if one B.Th.U. is as good as another, must not the whole of the plant be increased in size *pro rata*?

Is it not a fact that all our plant must be increased in size, not to cope with a certain yearly or monthly demand, but to cope with the one mid-winter week which may or may not come to test the qualities of our resources? This peak load can be narrowed down, so far as the distributing plant is concerned, to the heaviest hour of a summer Sunday, when everyone (in pre-war days) wished to cook the weekly joint at the same time. These are practical problems which cannot be lightly brushed aside in considering the *pros* and *cons* in comparing 550 B.Th.U. (gross) gas with the 450 to 350 B.Th.U. variety. Ought we not to look upon a gasholder as a storage of British thermal units? If so, a holder of 550,000 c.ft. capacity is reduced to one of 400,000 c.ft. capacity by reducing the gas from 550 to 400 B.Th.U. Are not the bulk of our consumers' meters greatly overloaded when the cooker and the gas-fire are alight together? And do they not register slowly and swell the unaccounted-for gas, when being used under such conditions? Will not all these meters be reduced in size in the ratio of 550 to 400 when the quality of the gas is lowered from 550 to 400 B.Th.U.? And will not this decrease in capacity substantially increase the unaccounted-for gas, unless most of these meters are exchanged for those of larger capacity? How are we going to supply the outskirts of our district on that foggy and frosty day when the main of a capacity of 55,000 c.ft. per hour will only pass 40,000 c.ft.? Nothing but relaying the main will satisfy the angry owner of the factory at the end of the main who lost a whole day's work by reason of our failure to maintain sufficient pressure.

Such instances could be multiplied indefinitely; but sufficient has been said to draw attention to a few of the points which will have to be considered by those engineers who do not, when first faced with difficulties, follow the line of least resistance, and take the step which eases the present position at the expense of troubles in years to come. It is assumed that all such considerations as are outlined above have been duly weighed by those who have plumped for, and are supplying, a low-grade gas. A good many of us are not taken in by the theory, which some have magnified into the term "fact," that 1 c.ft. of 350 B.Th.U. gas will do the same amount of work as 1 c.ft. of 500 B.Th.U. gas. We all know that immense improvements can and will be made in gas-burners; but let the work be done on a high, not on a low, grade gas.

In pre-war days, the cost of making gas was somewhat as follows: One-third was spent in cost of manufacture, one-third in cost of distribution, and one-third in cost of capital charges. It is argued above that the bulk of the plant on which the capital is spent must be increased in size *pro rata* to the quality of gas supplied. If, for the sake of argument, we assume that one-third of the cost of gas is represented by capital charges, and these amount to 10d. per 1000 c.ft., and of this amount 7d. is represented by that part of the plant which must be increased in size if the quality is reduced, it will be seen that the figure in question—viz., 7d.—will be increased in the ratio of 4 to 5·5, or to 9·6d. per 1000 c.ft.; thus making capital charges 12·6d. per 1000 c.ft., instead of 10d. Can any savings in manufacture possibly compensate for this?

Again, let it not be forgotten that one of the main reasons for the use of gas in place of coal has been due to the convenience and the speed with which work can be done. A kettle can be boiled more quickly, and a room heated, or a hot bath obtained, in half the time. But let the kettle take seven or eight minutes instead of five to boil, and the hot bath take twenty-five instead of fifteen minutes, and one of the great advantages of gas disappears. The time factor is all-important, whether the lady of the house or the cook is doing the work.

It may be that, in spite of the disadvantages mentioned above, the supply of a low-grade gas will enable a gas undertaking to sell heat at a reduced price, and to sell more of it. This may or may not be; but let us consider the question from all points of view, and not hurriedly take that line of least resistance which brings so many to the Bankruptcy Court.

Mr. H. B. Renwick has resigned the position of Director of Feeding Stuffs under the Ministry of Food, in consequence of the urgent demands on his time in connection with the electricity supply of the country.

SOUTHERN DISTRICT ASSOCIATION OF GAS ENGINEERS & MANAGERS

THE General Meeting of the Association was held last Thursday, at the Royal Society of Arts, John Street, Adelphi, W.C. The PRESIDENT (Mr. W. B. Farquhar, of Ilford) was in the chair.

VICTORY.

The PRESIDENT said before commencing the business of the meeting he should like to congratulate the members of the Association in being, if not the first, at least one of the first, to meet in the days of peace after the war. The Southern Association had always been in the forefront of all movements for the furtherance of the industry; and it was therefore very gratifying that it should be meeting so soon after the strenuous times through which the country, and the industry with it, had been passing. There was no doubt the industry as a whole had done wonderful work in helping to bring this great upheaval to a successful and glorious conclusion. The members of the gas profession had devoted a great deal of time and very unselfishly, at great inconvenience, to carry out the many regulations and to comply with the wants of the Government. Many of these regulations had been against the industry; but still the gas companies and gas committees and their officials had always sunk individual considerations to keep everything going for the benefit of the country. It was certainly very encouraging to know that they were now looking forward to an improvement in conditions—not only of employment, but also in the way of getting the necessary material for their works. So far as works construction was concerned, they had absolutely lost four years; and it was going to take a very long time, and a great deal of money, to make up for this lost time. He could only sincerely hope the Government would remove as soon as possible their restrictions on material, so that this very essential industry would be able to proceed with the necessary work to enable the carrying out of their obligations. It was hardly necessary for him to say anything with regard to the satisfactory conclusion of peace on the terms laid down by the Allies. In bringing about this end, the gas industry had taken a noble part. [Applause.]

MINUTES CONFIRMED.

The HON. SECRETARY (Mr. H. C. Head, of Winchester) suggested that members should take as read the minutes of recent meetings, as contained in the reports published in the "GAS JOURNAL." The meetings referred to were the March meeting, at which there were 84 members present. There was also the visit to Ilford and Chingford; and in July a special meeting was held for the discussion of the rules. There was also the meeting, jointly with the Eastern Counties Association, to consider the tar scheme.

The minutes were confirmed.

ELECTION OF PRESIDENT AND OTHER OFFICE-BEARERS.

Mr. A. F. BROWNE (London) said he felt it to be a great privilege to be invited to propose the election as President for 1918-19 of the member of the Association bearing the honoured name of Livesey. Everybody would agree, and nobody would deny, there was no name that had stood higher in the history of the gas industry than that of Sir George Livesey. He was for many years the acknowledged leader of the industry. Most of those present would also recollect with feelings of the greatest appreciation Mr. Frank Livesey—a first-class engineer, and a most able and charming man. The knowledge that he bore this honoured name would be at once an inspiration and an incentive to their friend—the present Mr. Frank Livesey—to do his best for the industry. They knew that as a gas engineer he had already made his mark in connection with an important gas company. The members would forgive him (Mr. Browne) perhaps if he said that in his disposition Mr. Livesey was like his father—somewhat retiring. But still perhaps there were not too many modest men about to-day; and he (Mr. Browne) would be the last to assert that a retiring disposition was any disqualification in these days for any appointment of a public character. He rejoiced to think that Mr. Livesey was to be their new President; and he felt sure they would find in this position, and in the future which lay before him (because he was still a comparatively young man), that Mr. Livesey was a "chip off the old block," that he would do honour to the great name he bore, and that he would rise in the profession which he had chosen. The Association, he was also certain, would benefit greatly by his occupancy of the presidential chair during the coming year.

Mr. H. BAKER (High Wycombe) seconded the motion, which was heartily carried.

Mr. FRANK LIVESEY said he thanked the members most sincerely for the honour they had done him in electing him to be their President. It was a source of great gratification to him, and also of supreme thankfulness, that a state of peace had been arrived at before his year of office commenced. When looking back over the last four years of the war, he was conscious of the fact that the gas industry had combined its forces and organized itself, in order to advance its interests, and safeguard its rights; and in the combination of forces which had taken place, the parent Institution—the Institution of Gas Engineers—and the District Associations had played an important part. It was not too much to say that, if they had not in the past had these opportunities of meeting together, and becoming mutually acquainted, it would have been more difficult for them to have combined to form one team. He simply said this to convince the members that he was fully alive to the importance of maintaining the Association in a condition of activity and power; and he could assure them that during his year of office, he would do his best to safeguard the interests of the Association, and to the best of his ability he would try to maintain the undoubtedly high level which had been set by all his predecessors in the chair of the Association.

Mr. L. J. LANGFORD (Tunbridge Wells) proposed Mr. C. F. Botley, of Hastings, as the Vice-President. As all knew, Mr. Botley was a capable engineer, and one who took a deep interest in every branch of the gas profession.

Mr. F. SMALLBONE (Portslade, Brighton), in seconding, remarked that Mr. Botley's training warranted them in electing him to the vice-presidency. He was sure he would follow in the footsteps of his father.

The PRESIDENT observed that both the new President and the Vice-President were sons of gas engineers who had filled the presidential chair of the Association. This was somewhat of a coincidence.

The motion was heartily carried.

Mr. BOTLEY remarked that he need scarcely say, if only for old association's sake, how much he appreciated the honour that had been conferred on him.

On the motion of Mr. P. G. G. MOON (Bournemouth), seconded by Mr. J. FISHER (Tottenham), Mr. J. W. Whimster (Bath) was elected a member of the Committee for the unexpired term of Mr. Botley's office in that capacity.

Mr. D. T. LIVESEY (East Grinstead) proposed the election of Mr. L. Trewby as a member of the Committee. Like the President and the Vice-President, Mr. Trewby represented an honoured name in the gas profession. The descendants of the old standard bearers were coming forward, and worthily carrying on the work of the Association. Mr. Trewby had been Chairman of the Commercial Section, and those who met him from month to month, were assured that he would do honour to the work of the Committee.

Mr. PERCY DREWETT (Fareham) seconded the motion, which was heartily carried.

Dr. HAROLD G. COLMAN said he had to propose as a member of the Committee the name of a gentleman who was related to one whom they were proud of in the gas profession. The name was that of Mr. William Phillips, of Luton.

Mr. T. N. RITSON (Chichester) seconded the proposition, which was also cordially passed.

Moved by Mr. A. F. BROWNE, and seconded by Mr. C. F. BOTLEY, Mr. H. C. Head was re-elected Hon. Secretary and Treasurer. Some very kind things, but not to excess, were said regarding his services to the Association.

Messrs. A. Dougall and W. E. Price were re-appointed Hon. Auditors, on the motion of Mr. JAMES PATERSON (Cheltenham), seconded by Mr. FRANK DURKIN (Southampton).

NEW MEMBERS.

The names of eleven new members were added to the register, on the motion of Mr. LANGFORD, seconded by Mr. RITSON. They were, in the order announced by the Hon. Secretary, as follows: Mr. A. H. Richardson, of Tottenham; Mr. P. Thomas, of Wellington, Salop; Mr. F. W. Delafield, of Shepton Mallet; Mr. J. G. S. Lee, of Topsham, Devon; Mr. H. B. Chamberlain, of Trowbridge; Mr. R. W. Edwards, of Aldershot; Mr. J. W. Gibson, of Budleigh Salterton; Mr. W. B. Leech, of Beckton; Mr. Thomas Carmichael, of Portsmouth; Mr. R. Robertson, of Bristol; and Mr. R. C. M'Donald, of the South Metropolitan Gas Company.

ANNUAL REPORT OF THE COMMERCIAL SECTION.

The HON. SECRETARY presented the following report of the Commercial Section:

The Committee have pleasure in submitting the ninth annual report for the year ended Sept. 30, 1918.

Membership.—During the year twelve new members have joined; the total number of members now being 83.

General Meetings.—During the session thirteen general meetings have been held in London; the average attendance being 35 members. In addition, seven meetings have been held in the West of England: At Exeter, Devonport, Plymouth, and Taunton; the average attendance being twenty members.

Coal.—Deliveries have, generally speaking, been much below the average. Stocks are very much lower than are usually held; and the quality of the coal delivered has left much to be desired.

Coke.—Coke stocks during the session have been very heavy, but have gradually fallen, until now they are rather below normal. The price of coke has risen in the same proportion as the price of coal.

Tar.—Prices have been about the same as last year. Meetings have been held with regard to an agreement with the tar distillers upon a profit-sharing basis; and it is hoped that this will be finally approved and generally adopted during the coming year.

Sulphate of Ammonia.—The demand for this is still on the increase, due to the propaganda work with the Board of Agriculture and the Sulphate of Ammonia Association. Prices have been better, owing to the subsidy to the

makers paid by the Government. The supply of acid has been better, although the price has shown an advance.

Other Subjects Discussed.—(1) Insurance of works and benzol plants. (2) Insurance and carriage of benzol. (3) Wages and war bonus to gas workers. (4) Tar prices. (5) Schedule of protected occupations. (6) Financial hardships of gas undertakings. (7) Certification of works. (8) Charges for gas. (9) Coal supplies. (10) Priority certificates for gas-works supplies. (11) Use of gas for motor purposes. (12) Women in gas-works. (13) Fruit canning. (14) Ash in coal. (15) Meter and cooker rents. (16) Whitley report. (17) Aircraft insurance.

At some of the meetings held representatives of the Government Departments concerned were present, and gave very useful information. From the Coal Controller's office, Mr. Brand dealing with coal, and Mr. Pick and Mr. Gaunt dealing with coke supplies, have attended. Also Mr. Chichester, of the Ministry of Munitions, dealt at length with the question of the employment of women in gas-works.

The Committee are very pleased that the increased number of meetings held in London and the West of England have been so well attended, showing that the discussion of various subjects proved very beneficial to the members who attended.

There are still some undertakings that, though members of the section, have not yet been represented at the meetings; and it is hoped that in the coming year these undertakings may find it advantageous to arrange for a representative to attend, and so give the other members the benefit of their experience. It is also hoped that the membership will increase, as it is realized that only by a more general co-operation of members and a full discussion of matters appertaining to the gas industry, in a private and informal way, can the greatest assistance be given to the members generally.

Re-organization.—Your Committee had numerous meetings with the Committee of the Southern District Association of Gas Engineers in order to arrive at some arrangement whereby the two Associations could mutually be joined together for improved working results. The rules were revised and submitted to a general meeting of the Association and the Section, when they were referred back for further consideration.

The PRESIDENT remarked that, from the report, members would realize the amount of work that had been done by the Commercial Section; but to those who had attended the meetings, they really meant very much more than the report reflected. He moved approval of the report.

This was at once agreed to.

LIQUID PURIFICATION, AND THE SIMULTANEOUS RECOVERY OF SULPHUR AND AMMONIA FROM COAL GAS.

Mr. P. PARRISH (South Metropolitan Gas Company) read a paper on the above subject. The full text, with a report of the discussion, appears on p. 413.

THE COAL SITUATION.

Mr. THOMAS GLOVER and Mr. F. R. GOODRICH, of the Coal Mines Department, gave some information as to the coal position; and this will be found below.

This concluded the meeting; and the members subsequently had tea together in the library.

END OF THE WAR AND THE COAL SITUATION.

At the Meeting of the Southern District Association of Gas Engineers and Managers last Thursday, one of the items down for discussion was the "Coal Position." But the President (Mr. W. B. Farquhar) said that time would not permit of a general discussion; and therefore if the members desired, the item would be missed. Mr. James Paterson, of Cheltenham, however, was not to be denied an opportunity of hearing something; and so he suggested that, as Mr. Thomas Glover was present, he should be asked to address the members on the subject. The President therefore invited Mr. Glover to give the members what information and consolation he could.

Mr. GLOVER said he had no objection whatever to doing what he could as he had been trying to do all along. But he was in the happy position of having brought along someone better informed than himself, and who was in fact steeped, in this matter of coal stocks of gas-works, and with the efforts that had been made—and they were very considerable—to get stocks satisfactory before the winter was really upon them. He (Mr. Glover) set the department a certain standard at which to aim some time in the early autumn—that was to say, four weeks' stock for gas-works generally, and six weeks for the works most distant from the coal-fields. Endeavours had been made to reach the standard; but, owing to the fearful shortage, there had not been success in some instances. Those gas-works which were in a position to take his advice, and were wise enough to start early, were those that were in the best situation in regard to coal stocks. He knew of cases where they had worked up to 40 p.ct. of blue water gas, giving the consumers an excellent quality gas, and with good effects upon the coal stocks. He knew works where they had four weeks' stock of coal, and where blue water gas was used. He knew another works in the same neighbourhood, which were only now putting in a water-gas plant, and which until lately had only a little over two weeks' stock of coal in hand. Some works that had been prohibited from getting Durham coal lately—owing to the tremendous demand, the loss and shortage of shipping, and the shortage of coal in the Durham fields—were now being permitted to draw Durham supplies again. The position was being improved in this respect; and they all hoped that the cessation of the sinking of ships, and the possible easement of the shipping position generally, would help the southern gas-works to draw their supplies, and larger supplies, by sea, and thus relieve to some extent the railways, and also help the mines. He would ask his colleague in the Coal Mines Department, Mr. Goodrich, to give the members some information.

Mr. F. R. GOODRICH said that he was somewhat at a disadvantage. Mr. Glover asked him if he would come along to the meeting, and give the members any information which they might require in regard to coal stocks. He had not had any specific questions put to him, so he could only attempt to give a general idea of what was the position at the present time. As the members knew when this matter was, at the request of Mr. Glover, taken in hand on an organized basis a few months ago, the situation in a large number of works was very serious, and the outlook for the winter was rather dismal. It had been possible by means of equalizing stocks, and by doing all they could to get additional supplies, to considerably improve the position in a large number of works. He thought he might say that on the previous Friday there were what they called August stocks held in about 450 works out of 1500. This was not a large proportion; but it did, at any rate, mark a distinct advance on the position of three or four months ago. It had meant the diversion of a very large quantity of coal. He had been looking into the figures, and found that during the last two months they had diverted from gas-works alone no less than 125,000 tons to works where stocks had been very low. But Mr. Glover hit the nail on the head when he referred to what had been done with regard to water-gas production. He worked hard on the matter months ago, when he tried to induce a considerable number of gas engineers to put forward their best efforts in this direction. The figures that had been got out for the month of October showed that 188 works were making blue water gas. Of their gas output, the average for the month was 18 p.ct. of blue water gas. He thought this was a very distinct advance from anything that was done before; and this had materially helped, as Mr. Glover had pointed out, in the accumulation of stocks. As to the future, it was very difficult to say anything at the moment. The end of the war had come upon them so suddenly, and there were so many matters that affected this question of coal supplies, that things were more or less in a state of flux. It would therefore hardly be possible for another week or two to give any definite idea as to what the position was likely to be. At any rate, he thought they might look forward with every confidence to a very definite improvement in the near future.

GAS EQUIPMENT FOR NATIONAL KITCHENS.

Experience at Derby.

In view of the extensive publicity which has been accorded to electric cooking equipment recently installed in certain National Kitchens, it is of interest to note the experience at Derby, where gas alone is used for the purpose, with gratifying results to all concerned. There are already two of the kitchens in operation; and a third is expected to be in working order very shortly.

The second, and larger one, was formally declared open last Friday week by Lady Ley. The accommodation is very extensive, there being large downstairs and upstairs dining-rooms; and as already stated, the whole of the cooking is done by gas, a very large installation of gas cooking equipment having been installed by the Derby Gas Light Company. Actual tests made at the first National Kitchen show that the cost of gas, at 3s. per 1000 c.ft., is only 4½d. per hundred portions of food cooked, &c.

The Mayor (Councillor E. J. Hulse) alluded to the great success that had attended the first kitchen in St. Peter's Street, where during the previous week 8252 portions were served, in contrast with 3325 portions during the first week. He felt that the National Kitchens were a great boon to the town, and said they were indebted to the Derby Gas Company for the quick and efficient way in which they supplied and fixed all the cooking equipment. The fitting-up was carried out very expeditiously, and everything was working satisfactorily.

The New National Gas Council.

Referring editorially to the scheme for the reconstitution of the National Gas Council, the "Birmingham Gas Department Magazine" says: "It is evident that a central organization such as it is intended the National Gas Council should be should exist to fully represent the gas industry in the important problems which will be presented after the war. There appeared to be apprehension in the minds of some of the members of the Institution of Gas Engineers that the Institution would be relegated to an inferior or subordinate position if the reconstituted National Gas Council were formed. We cannot see why this feeling should exist, as all the organizations will be able to pursue their particular and special functions as heretofore, with the added assistance of a central body, on the Executive Board of which they will be represented. The basis on which it is proposed that the National Gas Council should be reconstituted is a broad one, and is fully representative of both large and small undertakings, whether owned by municipalities or companies. The National Gas Council will now represent the central organization; and it will be necessary for the various Associations to work in close accord and harmony with the Council, to ensure a successful future for the gas industry." The Editor (Mr. R. J. Rogers) expresses the hope that we have heard the last of any suggestions of separate organizations for the company and municipal gas undertakings.

At the next meeting of the Newcastle Section of the Society of Chemical Industry, Mr. W. Diamond will read a paper on "The Estimation of Sulphur in Spent Oxide;" and Mr. G. Weyman one on "The Activity of Iron Oxide in Gas Purification."

SOME OBSERVATIONS CONCERNING (A) LIQUID PURIFICATION OF, AND (B) THE SIMULTANEOUS RECOVERY OF SULPHUR AND AMMONIA FROM, COAL GAS.

By P. PARRISH, A.I.C.

[A Paper read before the Southern District Association of Gas Engineers and Managers, Nov. 14.]

Event has succeeded event during the last few weeks with such extraordinary rapidity as to make the tacit prediction indicated in the opening sentence of my paper as originally written somewhat belated. However, we rejoice at the result. Never again must the gas and chemical industries find themselves in the position in which they were, all too unfortunately, placed at the outbreak of hostilities in the month of August, 1914. The supreme crisis from which we have emerged triumphant has undoubtedly led to a very considerable revision of our views on many subjects. Hitherto the cognate sciences of chemistry and physics have been insufficiently applied to the control of the operations involved in the manufacture of coal gas and the recovery of the resultant bye-products. It is not improbable that increasing importance will be attached to the application of these sciences in the conduct of gas-works' operations in the near future. In face of the developments presaged, it occurred to the writer that the consideration of some observations concerning liquid purification and the simultaneous recovery of sulphur and ammonia from coal gas may be of interest, and would doubtless evoke a discussion which would be mutually advantageous.

HISTORICAL.

The idea of liquid purification is certainly far from novel. Indeed it would appear that the late Richard Laming first broached (prior to 1860) the idea of the entire purification of coal gas by means of ammonia. He apparently purified his ammoniacal liquor by oxide of iron. In this way hydrogen sulphide was removed, and the purified liquor was fed to, and suitably distributed over, the packing medium of the scrubbers. It is recorded that this process was applied at the Bow Common Gas-Works; and as far as one could ascertain, it was successful in the removal of the bulk of the H_2S. Later, Hathaway introduced an improvement by which the furnace gases used in heating the retorts were utilized to effect the decomposition of the ammonium sulphide and the ammonium hydrosulphide of the gas liquor. The furnace gases from the retort-settings were led to a scrubber, through which ammoniacal liquor was passed. Records can be found in the Technical Press which indicate that the process was a success so far as the elimination of H_2S was concerned; but it appears that this *modus operandi* was abandoned by reason of the loss of ammonia.

Subsequently, the late F. C. Hills discovered that by heating gas liquor to a temperature a little below boiling point, he could drive off the CO_2 and H_2S without losing ammonia—thereby securing practically a caustic ammonia. The Hills process of liquid purification was introduced by the late Sir George Livesey, and put into operation at the Old Kent Road Gas-Works many years ago, and a considerable portion of the gas produced at the works was for many years partially purified, from H_2S and CO_2. Later, Claus further adapted the process devised and worked by Hills, and installed plant and operated his process at the Windsor Street Gas-Works of the Birmingham Corporation. Afterwards the Claus process was applied on a larger scale at the Belfast Corporation Gas-Works. In a contribution to the Institution of Gas Engineers, the late Mr. James Stelfox described the operation of the process, furnished results, and, with commendable frankness, ascribed the failure of the process to a so-called spectre—presumably a somewhat obscure loss of ammonia arising in the operation of the plant.

In more recent times, liquid purification was introduced for a time by Mr. Thomas Holgate, at the Halifax Gas-Works, and by Dr. W. B. Davidson, at Birmingham. It is not unlikely that success would have been achieved but for the outbreak of war, which led to the temporary discontinuance of the process at Birmingham.

The foregoing is not intended to be anything other than an epitomized historical survey; but it is hoped that it will be found substantially accurate, and will serve as a suitable introduction to the subject.

The exigencies of the war have necessitated the erection of a large number of plants for the production of concentrated ammonia liquor; and as many of these plants have already been put out of action by reason of modified methods and policy, as adopted by the "powers that be," the writer has received from time to time several inquiries concerning the possible utility of these plants in post-war times. The primary purpose of this paper is to suggest two possible ways in which concentrated ammonia liquor plants can be satisfactorily and suitably employed after the war. But as their application for the purpose to be suggested cannot be embarked upon without careful deliberation of the many considerations involved, the writer is wishful to deal with these aspects as fully as time will admit.

PROCESS OF LIQUID PURIFICATION: OPERATIONS AND CONSIDERATIONS INVOLVED.

Broadly speaking, the system or process of liquid purification contemplates the complete purification of gas by effecting the combination of the acid and alkaline impurities to form salts which are readily soluble in water or weak ammoniacal solutions in circulation in a series of suitable towers. The process is one which is in operation continuously in all gas-works every day. As, however, the acid impurities preponderate, ammonia must be added in adequate quantity to obtain the necessary combination.

The process involves four operations, as follows:

(1) That in which the gas is purified.

(2) That in which the dissociation of the ammonium compounds—such as ammonium sulphide, ammonium hydrosulphide, ammonium carbonate, and ammonium bicarbonate—is effected in order to remove the acid gases from the foul liquor.

(3) That in which the purified liquor is distilled, with the consequent production of ammonia, which is used in the scrubbers for arresting the acid impurities.

(4) That in which the acid gases arising from the dissociation of the ammoniacal liquor are utilized: (*a*) By combustion for the production of SO_2 in connection with the manufacture of sulphuric acid, or (*b*) where the H_2S is recovered as Claus sulphur.

THEORETICAL PHASES OF THE PROCESS.

Before proceeding to a detailed consideration of the various operations necessitated in liquid purification, it will be not inexpedient to examine certain theoretical phases of the process in the light of the practical data available. Analyses reveal the presence of from 550 to 700 grains of H_2S per 100 c.ft. of gas at the inlet to the purifiers; or, assuming in all cases a make of 13,000 c.ft. of gas per ton of coal carbonized, this represents 10·21 to 13 lbs. of H_2S per ton of coal. Also 30 to 40 grains of CS_2 (more often 30 than 40 grains) are present per 100 c.ft. of gas at the inlet to the purifiers, or 0·56 to 0·74 lb. of CS_2 per ton of coal. Approximately 90 grains of HCN are present per 100 c.ft. on the outlet of the last scrubber, or 1·67 lbs. of HCN per ton of coal. Approximately 1800 grains of CO_2 per 100 c.ft. are present in the gas on the inlet to the washers, and 350 grains of CO_2 per 100 c.ft. are absorbed by the gas liquor in the washers and scrubbers. Thus 1450 grains of CO_2 per 100 c.ft. must be removed in any process of liquid purification, or 30·6 lbs. of CO_2 per ton of coal carbonized.

Taking the data furnished above, which represents actual large-scale working, it is seen that a maximum of 13 lbs. of H_2S, 30·6 lbs. of CO_2, 0·74 lb. of CS_2, and 1·67 lbs. of HCN have to be removed per ton of coal carbonized. To what extent will it be necessary to augment the circulation of ammonia in order to secure the combination of the acid impurities? The reactions involved, viewed in the simplest form, are as follows:

(*a*) $2\,NH_4OH + H_2S = (NH_4)_2S + H_2O$
as NH_3 34 34

(*b*) $NH_4OH + H_2S = NH_4HS + H_2O$
as NH_3 17 34

(*c*) $2\,NH_4OH + CO_2 = 2(NH_4)CO_3 + H_2O$
as NH 34 44

(*d*) $NH_4OH + CO_2 = NH_4HCO_3 + H_2O$
as NH_3 17 44

*(*e*) $(NH_4)_2S + CS_2 = (NH_4)_2CS_3$
as NH_3 34 76

*(*f*) $NH_4OH + HCN + (NH)_2S_3 = NH_4SCN + (NH_4)_2S$
as NH_3 17 27

It is conceivable that other and more involved reactions than those marked by the asterisks (*) would occur; and it is equally conceivable that neither of the two reactions proceeds to completion. Ground Sicilian thirds sulphur could be introduced to the scrubbers in a suitable form in order to promote the formation of ammonium polysulphides, with a view to facilitating the removal of the HCN—one of the bugbears of the gas engineeer, by reason of the destruction caused to plant, mains, and meters, &c. If it were deemed desirable to recover the hydrocyanic acid in such a form as to yield a product with a satisfactory monetary value, possibly an installation of two purifiers of satisfactory size, charged with suitable spent oxide, and worked on the basis of the Williams process—interposed between the tar extractor and the closed purification plant—would serve for the purpose.

The liquor, consisting chiefly of ammonium sulphate and ammonium sulphocyanide, together with smaller quantities of free ammonium compounds and sulphate of iron, &c., resulting from the spraying of the spent oxide containing the arrested cyanide compounds, with water under pressure, could be collected and distilled with baryta. The ammonia released could be returned to the gas-circuit, and the cyanide recovered as barium sulphocyanide, of 30 p.ct. concentration. This product ($Ba(SCN)_2$) is used in lieu of strong sulphuric acid in the parchmentizing of paper. Alternatively, the Davis-Neill process for the removal of cyanides could be adopted.

Proceeding now to the equations:

13 lbs. of H_2S, based on reaction (*a*), will be removed by 13 lbs. of NH_3, and

30·6 lbs. of CO_2, based on reaction (*c*), will be removed by 23·7 lbs. of NH_3.
0·74 lb. of CS_2 may conceivably be removed by 0·33 lb. of ammonia (NH_3), and 1·67 lbs. of HCN may conceivably be removed by 1·05 lbs. of NH_3.
Altogether 38·08 lbs. of ammonia are required in circulation to effect the combination of the acid impurities in the crude coal gas.

The yield of ammonia per ton of coal carbonized may be based on the production of ammonium sulphate, which in the case in question is equivalent to 30 lbs., containing 25 p.ct. of NH_3 per ton of coal carbonized. In other words, 7·5 lbs. of NH_3 are recovered. No attempt has been made to determine the extent to which the reactions represented by equations (*b*) and (*d*) proceed, or to establish the partial or complete feasibility of the reactions as represented by equations (*e*) and (*f*). These are doubtful points which demand investigation. In any case, the quantity of ammonia required in circulation is not materially affected by the reactions in question. Indeed, an allowance of 5 p.ct. would conceivably cover all four reactions. It is evident, therefore, from the data already furnished, that $\frac{38{\cdot}08}{7{\cdot}5} = 5{\cdot}077$ times the quantity of NH_3 present in the gas is the minimum quantity required for ensuring satisfactory purification of the crude coal gas by the process under review.

As the volume and composition of the gas vary from day to day—even from hour to hour—these variations can only be satisfactorily met by maintaining in stock in the scrubbers or circulating tanks (if used) an excess quantity of caustic ammonia, so as to provide against any conceivable variations or contingencies that may arise. The writer would certainly recommend the desirability of circulating at least seven times the quantity of ammonia available in the gas normally, so as to afford the necessary reserve suggested.

DETAILS OF DESIGN AND ARRANGEMENT OF PLANT.

Coming now to the design and arrangement of the plant for effecting the purification of gas by the method under review, and taking these in seriatim order, past experience would suggest that this portion of the plant should embody at least three essentials:

(1) Adequate contact should be obtained between the coal gas and the re-circulated gaseous ammonia, in order to allow of the formation of the soluble ammonium compounds which are to be absorbed in the ammoniacal solutions and water being circulated. As the reactions involved necessitate time, as also does the absorption of the soluble ammonium compounds, the size of the vessels and the free space of the packing medium (assuming packed scrubbers are used) should be sufficiently large to allow of these desiderata being secured.
(2) The gas to be purified should be freed as effectually as possible from tar and hydrocarbons, which are likely to accumulate and eventually prevent the satisfactory and efficient working of the packing medium used.
(3) The relative merits and demerits should be carefully considered of: (*a*) Vertical scrubbers provided with suitable filling medium, which necessitate the installation of a series of bottom circulating tanks and pumps; (*b*) horizontally disposed mechanical washer-scrubbers arranged in cascade form, in which a counter-current is established between the gas and re-circulated gaseous ammonia and the absorbing liquors and water.

Advantage could in many cases be taken of the varying levels of the site on which the projected plant is to be erected for dispensing with the necessity for pumping these circulating liquors. In this way loss would be averted of ammonia by spillage at the pump glands, and that which is carried away with the displaced air from the storage tanks. These sources of loss in the past have contributed largely to the failure of liquid purification as a practical process. Indeed, in the writer's view, herein lies the possibility of relegating to the limbo of forgotten things the spectre of which the late Mr. Stelfox so eloquently spoke.

In the lucid paper on the Claus ammonia process of gas purification read by Mr. Charles Hunt, M.Inst.C.E., to the Gas Institute in 1886, dimensions are given of the experimental plant he operated. Six scrubbers in all were used for the purification of the gas—five being 4 ft. square and 20 ft. high, filled with broken ganister bricks supported on cross angle-irons, while the sixth scrubber was 5 ft. in diameter, and 25 ft. high. The function of the latter apparatus was as a "finisher" or "catch," in order to arrest the last traces of impurity. The plant described was said to be equal to the purification of about 250,000 c.ft. of gas per diem; a maximum of 300,000 c.ft. having been obtained. Assuming the free space of the ganister brick packing per cubic foot to be 0·4, and the superficial free space per square foot to be 0·35 (not improbable figures), the velocity of the gas would be:

$$\frac{250{,}000}{24} \times \frac{1}{3600} = 2{\cdot}9 \text{ c.ft. per second.}$$

The superficial free space of the scrubbers Nos. 1 to 5 is 4 ft. by 4 ft. = 16 sq. ft. × 35 p.ct. = 5·6 sq. ft.

$$(a)\ \text{Velocity} = \frac{2{\cdot}9}{5{\cdot}6} = 0{\cdot}52 \text{ ft. per second.}$$

Superficial free space of the final catch tower 5 ft. by 5 ft. by 0·78 — 19·5 sq. ft.

19·5 sq. ft. × 35 p.ct. = 6·825 sq. ft.

$$(b)\ \text{Velocity} = \frac{2{\cdot}9}{6{\cdot}825} = 0{\cdot}42. \text{ ft. per second.}$$

The total time-contact in the plant cited would be 251 seconds, or 4 min. 11 sec. From fairly extended experience of chemical reactions almost identical in character to those arising in liquid purification, the writer would be inclined to double the time-contact as the only certain way of securing efficient purification. As, however, such provision entails the duplication of the plant, and as any such duplication involves capital outlay, it is desirable to examine other arrangements of plant in the hope that the necessary time-contact, or something equivalent to it, may be attained without incurring twice the initial expenditure.

The plant under immediate consideration admits of reaction between the gaseous impurities and the liquid absorbents by film or surface-contact. However effective the wetted surface of the packing medium may be, or however absorbent or porous, or however tortuous or devious the path of the gases may be, those who have had occasion to investigate the conditions affecting the absorption of soluble salts by liquids possessing considerable power of absorption, know that (other things being equal) film-contact is not nearly so effective as the actual bubbling of the gaseous compounds to be absorbed through the absorbing medium, provided something approaching equable distribution of the gases through the available liquid space is secured.

The positive nature of the contact, where actually forcing of the gases through the absorbing medium is effected, is strikingly demonstrated if one attempts to compare the absorption of the released gases from the dissociator of a concentrated ammonia liquor plant working under identical conditions: (*a*) In an absorber constituted of a series of trays, arranged in such a form as only to allow of film contact; and (*b*) an absorber where the gases have to be efficientiy distributed through a definite number of seals of absorbing liquor. The size of the plant in example (*a*) will be more than two-and-a-half times the size of the plant in example (*b*). Only one drawback attends the latter, which is the extra resistance or back-pressure caused by actually forcing the gases through a series of seals as compared with the skin-friction arising from film-contact.

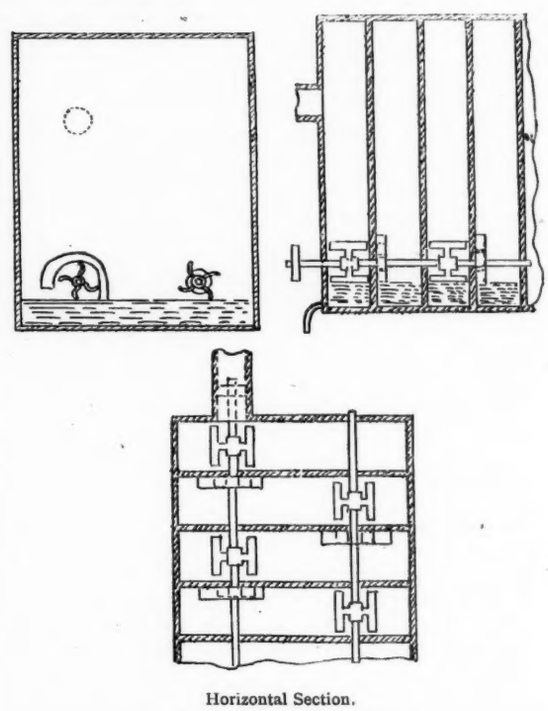
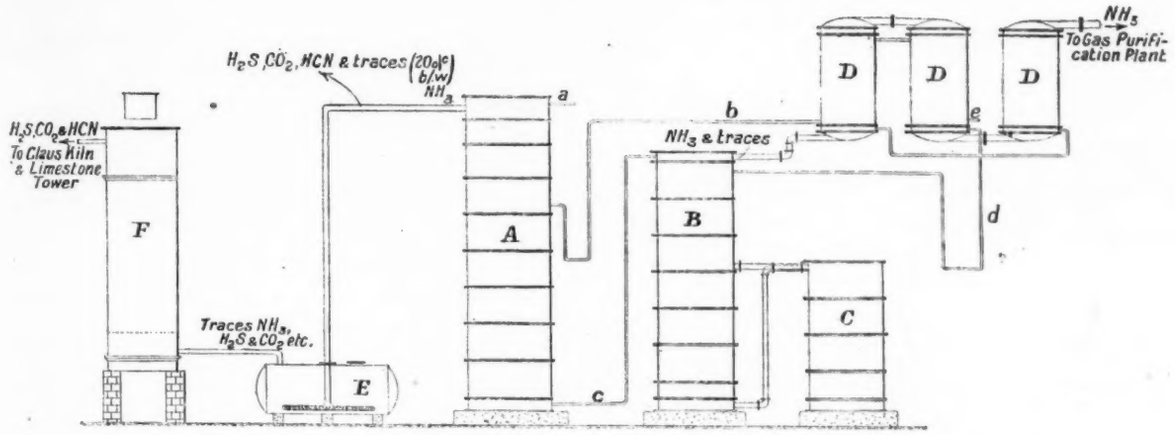


Fig. 1.—THE TREPEX WASHER.

This leads the writer to the view that the scrubbers for admitting the combination of the acid and alkaline impurities and the absorption of the soluble ammonium salts so formed should embrace some positive arrangement of actual contact. Further, with a view of obviating the pumping of the absorbing liquor from tower to tower, and the provision of storage tanks at the foot of such towers, a series of horizontally disposed washer-scrubbers of the Trepex type, designed to give positive contact, would be a decided advantage. If the latter plant embodied at the same time an arrangement for creating a "brouillard" by the operation of a splasher, and if the various Trepex vessels were arranged in cascade form, so as to admit of the circulating liquors being gravitated from vessel to vessel, without doubt a satisfactory solution would be afforded to the difficulties which it would appear obsessed



A. Dissociator; *a*, cold gas liquor. B. Free NH_3 still; *b*, preheated gas liquor. C. Fixed NH_3 still; *c*, caustic ammoniacal liquor. D. Dephlegmators; *d*, refluxes. E. Crude ammoniacal liquor vessel; *e*, gas liquor inlet (for preheating). F. Tower scrubbers.

FIG. 2.—PLANT FOR SEPARATING H_2S, CO_2 AND NH_3 FROM CRUDE GAS LIQUOR.—Type A.

the minds and dogged the original workers of this process through the whole period of their experiments. A sketch of the Trepex apparatus is given in fig. 1; but the arrangement illustrated does not embody any definite seal. The provision of this desideratum can be easily made.

DISSOCIATION OF GAS LIQUOR AND PRODUCTION OF CAUSTIC AMMONIA.

Coming now to operations Nos. 2 and 3 (which the writer proposes to deal with collectively), it is evident that the late Mr. F. C. Hills had a very clear conception of the physico-chemical laws involved in the production of causticized liquor. It is equally obvious that any failure of his, or the Claus, process cannot be ascribed to the absence of appreciation of these laws, but rather to imperfect application of sound mechanical and chemical engineering principles.

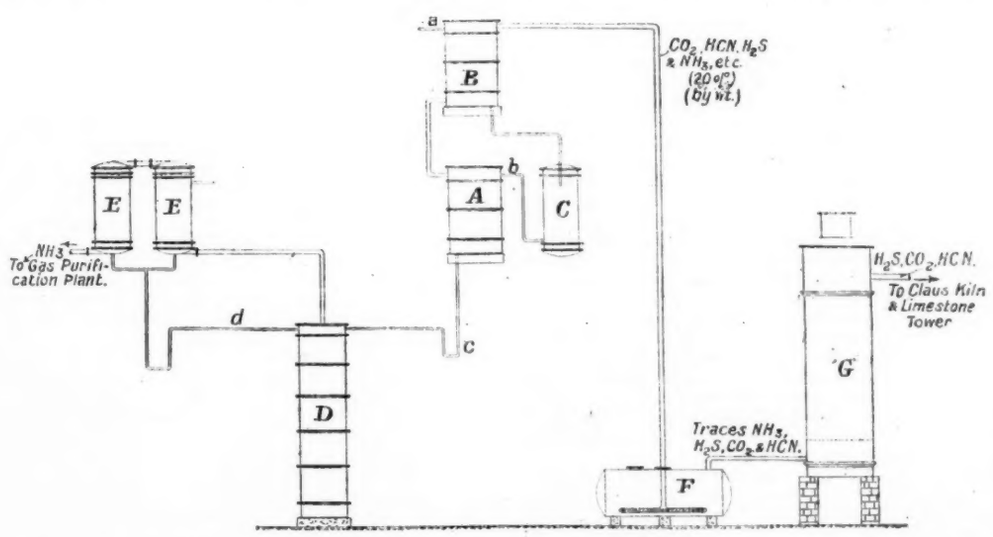
Hills's process takes advantage of the laws of chemical affinity and physical solution on the counter-current principle. The ammonia, hydrogen sulphide, and carbon dioxide, &c., present in gas liquor are in chemical combination; and, as such, the individual tensions of the latter chemical compounds are appreciably less than when they exist in the free state. The application of heat to about 160° Fahr. results in partial disunion; and the three gases cited then largely exist in solution—not as carbonate, sulphide, and hydrosulphide, but (in conformity to Henry's law) as free gases soluble in water, under equal conditions.

The solubility of ammonia in water in like condition is appreciably greater than H_2S or CO_2. Hence the latter acid gases are dispersed, while the NH_3 is held in solution. As, however, the acid gases, on discharge from the water, carry with them a certain amount of water vapour by entrainment, a small quantity of ammonia held in solution in the water is removed. Expressed in another way, there is equilibrium between the tendency for the water to retain ammonia and the water vapour and acid gases to withdraw ammonia under the conditions of pressure and temperature obtaining during release.

It is to be regretted, however, that the inventors of the process for the desulphurizing and decarbonating of ammoniacal liquor by the application of steam heat should have made too extravagant a claim for their process. The broad generality was enunciated by Hills, and emphasized by Lunge in his "Treatise on Coal Tar and Ammonia," to the effect that if gas liquor were heated by steam to a temperature slightly below boiling point, the whole of the H_2S and CO_2 would be expelled with little loss of ammonia. The writer's experience suggests that this broad generalization cannot be accepted without some qualification. He attributes the somewhat imperfect design of many concentrated ammonia liquor plants which have been installed during the past two or three years to the inculcation of this principle, and to a lack of actual experience of the principles involved in desulphurizing and decarbonating gas liquor on the part of those chiefly responsible for the design of these plants.

PRINCIPLES GOVERNING DISSOCIATION.

Continued operation of this type of plant, dealing with gas liquor containing on an average 1·73 p.ct. of NH_3, 1·2 p.ct. of CO_2, and 0·3 p.ct. of H_2S (all weight by volume) reveals the necessity for extreme care in the design of the dissociator and other vessels operating in conjunction therewith. If the H_2S content is to be reduced to 0·04 p.ct., and the CO_2 content to 0·12 p.ct. (both weight by volume) based on a content of 1·73 p.ct. of ammonia, W/V., in the final liquor, the plant in which dissociation of the gas liquor is effected, and in which the released ammonia arising in consequence of such dissociation is arrested, should embody several essentials. It has been found that there is practically a coinciden relationship between the boiling point of water and the point o



A. Dissociator; *a*, gas liquor inlet. B. Absorber for NH_3; *b*, partially cooled liquor. C. Multitubular cooler; *c*, reflux caustic ammonia. D. Ammonia still: *d*, dephlegmator reflux. E. Dephlegmators. F. Crude ammoniacal liquor vessel. G. Tower scrubber.

FIG. 3.—PLANT FOR SEPARATING H_2S, CO_2, AND NH_3 FROM CRUDE GAS LIQUOR.—Type B.

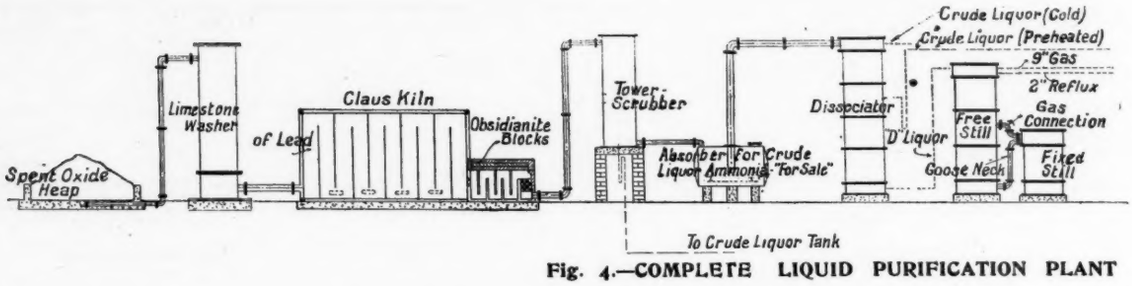


Fig. 4.—COMPLETE LIQUID PURIFICATION PLANT

almost complete dissociation of ammonium sulphide, ammonium hydrosulphide, ammonium carbonate, and ammonium bicarbonate present in ammoniacal liquor. If it is intended to obtain results such as are indicated by the figures just cited, then it will be necessary that the gas liquor in the terminal tray of the dissociator should attain a temperature coincident with the temperature at absolute pressure to which the liquor in the bottom or terminal tray is subjected.

[The author here referred to two continuous recording charts, the first showing the temperature in terms of degrees Fahrenheit of the gas liquor undergoing decomposition in the terminal tray of a dissociator in a unit of plant dealing with about 30,000 gallons of liquor per day. It was observed that the temperature was maintained steady throughout the twenty-four hours at an average of 215° Fahr. The second chart furnished a continuous record of the pressure in terms of inches of mercury existing in the terminal tray on the particular day in question. It was noted that the pressure fluctuated considerably. The writer attributed this to one of two or both causes—viz. (1) irregularity in the feed of the liquor to the dissociating plant, and/or (2) to a slightly inadequate provision of area for the ascent of the large volume of gases released from the liquor, and the consequent periodic absence of pressure equilibrium in the various trays constituting the still. The liquor undergoing decomposition on the day in question it was seen was maintained at an average temperature of 215° Fahr., and an average pressure of 2·5 in. mercury gauge.]

The pressure named is equivalent to 1·23 lbs. above atmospheric, or an absolute pressure of, approximately, 16 lbs. per square inch. Reference to tables furnishing the properties of saturated steam show that the boiling point of water under the computed absolute pressure is 216·3° Fahr. Actually, a temperature of 215° Fahr. was maintained on the day in question; and reference to the analyses of the gas liquor as fed to the still, and the caustic liquor leaving the dissociator shows that the CO_2 content had been reduced from 1·2 to 0·12 p.ct., and the H_2S content had been reduced from 0·35 to 0·04 p.ct. based on a content of 1·7 p.ct. of ammonia in the crude and caustic liquors. Continuous determinations of pressure and temperature over several months established the fact to which allusion has been made, concerning the coincident relationship between the boiling point of water and the point of almost complete dissociation of the ammonium compounds cited of the gas liquor. The attainment of the temperature indicated in the terminal tray of the dissociator resulted in the release of appreciable volumes of steam, ammonia, CO_2, and H_2S, &c. The volumes of vapour ascending the gas space from the bottom three or four trays is relatively large compared with that ascending the top three or four trays of the plant. This difference of volume must be contemplated when arranging the area of the spaces to be available for the ascent of the gases and the descent of the liquor in the various trays. Failing this, experience suggests that it is not unlikely that there will be an absence of equilibrium between the liquor in the lower trays and those above, with the result that the liquor on the upper trays will be prevented from flowing through the overflow arrangement provided. What will then occur is the accumulation of liquor in one of the upper trays, immersing the hoods, frogs, or bubblers (whatever device is arranged for the distribution of the gas), and there will be a violent conflict between the pressure of the gas and the accumulation of liquor. Occasionally, the liquor will accumulate to such a height in the decomposer as to overcome the gaseous pressure; and the dislocation will adjust itself. Not infrequently the direct steam will need to be reduced, in order to secure a reduction of pressure and the establishment of pressure equilibrium, when the liquor will once more commence to flow. It is at these times of derangement, when there is an unequable or erratic flow of liquor, that inefficient dissociation of the crude liquor occurs. The above phenomenon, curiously enough, was experienced by the superintendent of the Claus plant which was operated at Belfast, as several references are made by Mr. Stelfox to this disability and to the consequent stoppage of the plant.

Another point to which attention should be directed in designing the plant under review is to ensure that the trays are not placed too closely together. An ideal dissociating still, in the writer's view, would be one based on the following dimensions: The still should not be less than 4 ft. 6 in. internal diameter, provided with at least fifteen trays, each placed at 18-in. centres, and affording a liquor reserve at the foot of 2 ft. in height. The area of the gas-space in the bottom tray should be at least equal to 110 sq. in.; and the space for the descent of the liquor should be at least 16 sq. in. The gas spaces should progressively diminish in each succeeding tray, and should be based on the area of the bottom tray already named, and on the area of the outlet pipe from the dissociator, which need not be more than 50 sq. in. Such a dissociator will be capable of dealing with about 30,000 gallons of 8·oz. liquor per diem.

The temperature of the outlet gases arising from the operation of the suggested still will be approximately 110° Fahr. With a view of reducing this temperature somewhat, plants have been designed with an intermediate cooler, in which the liquor used for absorbing the released ammonia is cooled by passing through a multitubular water-cooler before being sent to the dissociation section proper. The partially-cooled liquor reduces the temperature of the evolved gases from the dissociation section; hence better absorption and a lower outlet temperature of the final gases are obtained. It is a matter of choice whether an intermediate cooler should be used in connection with the dissociating plant, or whether more adequate provision should be arranged for absorption in a single-column still. There are advantages and disadvantages attending the adoption and working of either type of plant.

TREATMENT OF THE WASTE GASES.

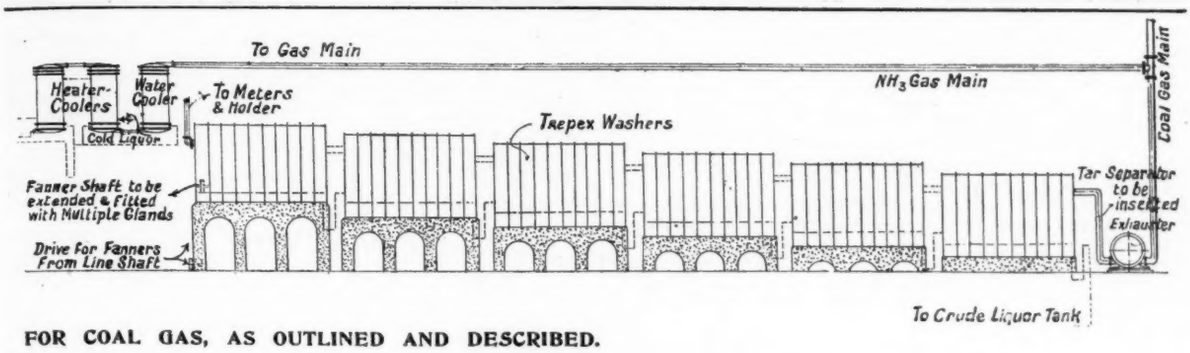
This now leads us to the treatment which the waste or effluent gases should undergo. These consist of hydrogen sulphide, carbon dioxide, pyridine, and HCN, together with the equivalent of 20 p.ct. of the gross weight of ammonia passed through the plant as gaseous ammonia.

Elsewhere ["JOURNAL," Vol. CXC., No. 2849, pp. 555·6] the writer has dealt with the peculiarly insidious character of the gaseous mixture named—emphasizing its dissimilarity compared with ordinary crude coal gas. He would suggest the desirability of arresting the ammonia coming forward with the waste gases in a capacious cylindrical boiler provided with a suitable cracker-pipe in water, so as to form a 15 p.ct. solution of ammonia. Although at this concentration the ammonia liquor would crystallize, it could be readily dealt with by carefully steaming the crystallized liquor—thus admitting of the loading of railway tank-wagons. There is a ready market for such liquor for the ammonia-soda process. The specification to which this crude ammonia has to conform is 15 to 18 p.ct. of NH_3 and as much H_2S as possible—3 p.ct. being very acceptable. Less than 1½ p.ct. is not regarded as satisfactory. If considered desirable, other ammonium compounds than crude ammonia liquor could be produced. As the waste gases in their passage from the outlet of the dissociating plant to the crude ammonia absorber would crystallize out upon cooling—forming a sublimate of ammonium carbonate and ammonium bicarbonate—it would be necessary to steam the pipe conveying the waste gases each eight-hour shift, so as to avoid trouble or blockage.

The gases leaving the crude ammonia absorber should pass to a tower scrubber. The liquor produced in this scrubber should be sent to the gas-liquor wells to be re-treated along with the other crude liquor. Probably not more than 6 p.ct. of the net total weight of the ammonia being decomposed will be arrested at this point. It is, however, essential that the gases should be scrupulously freed from ammonia, if they are to undergo combustion for the production of SO_3, for sulphuric acid manufacture, or if they are to be treated in the Claus sulphur-kiln.

To form some conception as to the arrangement of plant and the quantities of liquor to be dealt with, it is perhaps expedient at this juncture to ascertain the size of plant required for a works carbonizing 250 tons of coal per day. Based on 13,000 c.ft. per ton, 250 tons of coal per day represents 3,250,000 c.ft. of coal gas. The 250 tons of coal a day will result in the production of 250×7·5 lbs. of ammonia, or 1875 lbs. of ammonia. Expressed in terms of gallons of 8·oz. liquor, this represents 10,838 gallons per diem. Seven times 10,838 gallons, *plus* 6 p.ct. of 75,866 have to be decomposed per day, or 80,417 gallons. And 20 p.ct. *minus* 6 p.ct. equals 14 p.ct. of 80,417 gallons, equals 11,258 gallons. From this it is evident that approximately the proper quantity of liquor is being withdrawn per day in the form of crude ammonia liquor. The distilling plant will thus need to deal with the equivalent of 80,417 gallons per day of liquor of 1·39 p.ct. ammonia—assuming 8·oz. liquor is produced in the final scrubber, adjacent to the Claus kiln.

Details of the design of a dissociating plant to deal with about 30,000 gallons of 8·oz. liquor per diem have already been given; but it must not be supposed that to deal with the equivalent of



FOR COAL GAS, AS OUTLINED AND DESCRIBED.

80,417 gallons per diem several units of plant will be required. Indeed, at one or two chemical works in the United Kingdom producing pure, and other qualities of, liquid ammonia, decomposing stills, each capable of dealing with 100,000 gallons of 8-oz. liquor per day are in use. These are usually worked in conjunction with three or four stills for the distillation of the caustic liquor so produced.

One important feature of these larger units of plant is that they are usually erected on the ground-floor, and are worked at a pressure exceeding 20 lbs. per square inch. In certain cases working pressures of 40 lbs. per sq. in. are usual. Steel, and not cast iron, is used in the construction of these stills. Operating in this way, there is no necessity to pump the caustic ammonia liquor produced in the decomposing plant, as the pressure to which the liquor is subjected is such as to allow of it being fed direct to the finishing stills of the ordinary sulphate of ammonia type. Of course, an increased steam consumption is necessitated, because the liquor in the terminal tray has to attain a temperature of at least 285° Fahr., if the crude liquor is to be satisfactorily desulphurized and decarbonated. Another collateral advantage accompanying the use of high working pressures in the decomposing stills is that under the influence of increased pressure (two, three, or even more atmospheres) greater concentration of ammonia in the causticized liquor is attainable. This is likely to be a paramount factor in the success of any liquid purification scheme to-day. The consumption of steam required for decomposing the foul liquor is one of the principal items in the operation of a process such as that under review. Hence it is obviously essential that the volume of liquor to be decomposed should be reduced to a minimum by using the maximum concentration of ammonia in the caustic liquor.

The impression which one forms from a perusal of past literature and papers on the subject of liquid purification is that the desulphurizing portion of the plant was not altogether efficient, and that losses of ammonia arose by the failure to adopt a suitable way of dealing with the effluent or waste gases. Further, the loss of ammonia resulting from the pumping of the hot caustic ammonia liquor was appreciable, to say the least, as frequent comment is made respecting (*a*) the failure of the pumps, (*b*) leakage from the pet and drain cocks, and (*c*) loss of gaseous ammonia at the glands of the pump.

Finishing Stills.

It would be superfluous to deal at any length with the distilling plant, which is really part and parcel of the dissociating plant, operating and synchronizing with it. If a single unit, large-type dissociating still were decided upon, the liquor in which is to be subject to a pressure exceeding 20 lbs. per square inch (and the adoption of such a design of plant is commendable), then it would appear desirable to instal a single unit finishing still. The chief points to ensure are:

(1) That the still is of adequate size (probably 7 ft. 6 in. diameter will suffice), provided with trays affording intimate and positive contact between the ascending steam and gases and the descending caustic liquor to be distilled.

(2) The liming section of the still should be so arranged that intimacy of admixture between the milk of lime and the liquor containing the fixed ammonium salts is obtained, and that suitable access for removing any accumulations of sludge or deposit is afforded.

(3) The fixed still should be of similar diameter to the free still, and should be provided with a series of trays and such arrangements for the distribution of the steam through the liquor from which the final portion of the ammonia has to be expelled, as to ensure the intimate and positive contact already referred to.

(4) Too much attention cannot be directed to the plant for the production of milk of lime, and the method of feeding it to the finishing still. A gravity-sight-feed should be adopted in all cases, and the milk of lime should be freed from gritty and silicious matter before being distributed to the still.

(5) The dephlegmators for ensuring the production of gaseous ammonia free from water should be of adequate size. This is exceedingly important, as it would be unwise to tax the gas plant with additional cooling, especially as the gaseous ammonia would be introduced adjacent to the inlet of the exhauster—*i.e.*, after the condensers.

Utilization of the Waste Gases.

We are now brought to the final operation involved in liquid purification—viz., (*a*) the conversion of the waste gases to SO_2 for sulphuric acid manufacture, or (*b*) the recovery of sulphur from such gases in the Claus kiln.

Few works will be in a position to burn the H_2S in spent oxide burners to SO_2. It is a simple process. It is only necessary to ensure the admission of the gases, along with the requisite quantity of air, to a suitable flue of the spent oxide burners, maintained at such a temperature as readily to effect the ignition of the gases and promote satisfactory distribution by passing usually through a short length of chequer brickwork. The writer is not altogether enamoured of this method of dealing with the waste gases. The H_2S content scarcely ever exceeds 20 p.ct.; so that the sulphuric-acid chambers are supplied with gas of a diluent nature, occupying space with no correponding advantage in production. Again, the pyridine and cyanide bodies associated with the waste gases have a tendency to react with oxides of nitrogen generated in the potting oven, with consequent reduction of the oxides of nitrogen to free nitrogen. Further, diffusion of the hydrogen formed as a result of the combustion of the H_2S through the brickwork is another difficulty with which one is faced when dealing with waste gases in the manner under review. The writer strongly countenances the recovery of sulphur from the waste gases in a Claus kiln. As this is a process which has gained fairly wide adoption, and one with which, doubtless, most of the members are already familiar, it is only necessary to make reference to one or two special features in this connection.

The writer recommends that the first portion of the Claus kiln should be built of Obsidianite acid and heat-resisting bricks, with a special acid-resisting cement, such as is used now in connection with the large Gaillard, Kessler, Perrin, and other such acid concentration towers. The larger portion of the kiln through which the sulphur vapour, steam, nitrogen, and undecomposed H_2S pass after having dissipated some of their heat, should be built of lead—a sort of leaden chamber provided with a suitable number of baffles, and cooled by spraying water on the outside. These suggestions are made with a view to preventing the disintegration of the brickwork of which the Claus chambers are usually wholly built, and the admixture of such friable and disintegrated brickwork with the sublimed sulphur so produced.

The necessity for a catalytic medium (such as pyrites or iron oxide) appears to be partly exploded. Provided intimate admixture of the waste gases with the requisite quantity of air is secured and the temperature conditions are satisfactory, the reaction proceeds apace. But careful control is necessary should anything approaching a theoretical production of sulphur be wanted.

The writer has already suggested the desirability of removing the hydrocyanic acid from the crude coal gas for certain obvious reasons. In connection with the Claus process HCN exercises a baneful influence, and tends to appreciably reduce the yield of sulphur—chiefly by reason of its hydrolysis to NH_3 and the combination of the latter with SO_2, forming ammonium sulphite, which may ultimately be oxidized to sulphate. At any rate it is desirable to thoroughly wash all the sulphur recovered from the Claus kiln, with a view to removing the ammonium compounds and to centrifuge the sulphur before offering the material for sale and submitting samples. Otherwise, its market value may be affected prejudicially.

A tower of adequate size, packed with limestone, over which water flows, should be provided at the end of the chamber for arresting the remaining quantities of SO_2, SO_3, and probably some H_2S; the balance of the latter being removed by an oxide of iron heap.

The two foregoing pieces of apparatus are decidedly essential, because in their absence the gases from the Claus kiln are known to have shown acidities up to and beyond 12 grains of SO_3 per cubic foot.

References to the Engravings of Plant.

Figs. 2 and 3 (p. 415) show two types of a complete plant for the dissociation of gas liquor (by which the acid gases are separated from the ammonia) combined with plant for the distillation of the caustic ammonia for the production of gaseous ammonia to be recirculated to the purification plant.

Fig. 4 (above) shows in diagrammatic form a complete liquid purification plant for coal gas, as outlined and fully described in this paper.

FINAL CONSIDERATIONS.

One of the final points which occurs to the writer is this: Having regard to the absence of success with the Claus ammonia process of purification in the past, is it wise to recommend gas undertakings to embark on the process now? The answer to this question depends to a large extent on the financial aspect of the proposition, which unfortunately is outside the scope of this paper. It should be observed, *en passant*, that the production of cheap steam is essential. From the technical point of view, the writer sees no reason why purification in closed vessels—a very desirable process for many works—should not prove a complete success. An attempt has been made to elucidate the Belfast spectre and an arrangement of plant suggested which would, it is hoped, effectually overcome the obscure difficulties which baffled the original workers of this process.

So far as operations No. 2 and No. 3 are concerned, it is known that a 95 p.ct. efficiency is possible. If an arrangement of purification plant were adopted where gravitation (as distinct from pumping) is secured, and if adequate care were taken to wash all displaced air from the gas-liquor wells—using suitable oil on the surface of the gas liquor to prevent volatilization—there is no reason to suppose the over-all efficiency of the complete purification plant would be less than 93 p.ct. of the theoretical.

The inordinate length which this paper has already assumed will render it necessary to deal with the second branch of the subject—the simultaneous recovery of ammonia and sulphur from coal gas—in a succinct and rather cursory manner.

THE BURKHEISER PROCESS.

It is assumed that there is a general acquaintance with the Burkheiser process, which aimed at the production of sulphate of ammonia without the aid of sulphuric acid. Broadly speaking, two sets of purifiers were operated, and a special concentrated oxide of iron was used for the absorption of the H_2S from the crude coal gas. As soon as the special oxide had attained a definite content of sulphur, the stream of crude gases was transferred to another series of purifiers. Meanwhile, oxide of iron containing a definite quantity of sulphur was treated, or was subjected to a current of heated air, the temperature of which was carefully controlled. It was expected that the production of SO_2 would result, and the oxide of iron would be regenerated. The expected SO_2 so produced was to be led to one or other of the two saturators, which were to be worked alternately. The sulphurous acid was to be produced temporarily in one of the saturators, and the crude gases containing ammonia were to be led into the saturator containing the sulphurous acid, so as to secure a combination between the ammonia and the acid solution. Meanwhile, while this combination was being effected, the second saturator would be charged with SO_2. Thus sulphurous acid would be available therein. In this way, it was intended to produce alternately in the saturators or towers (whatever type of apparatus was finally decided upon) ammonium sulphite and ammonium bisulphite.

A method had been devised and patented for the oxidation of the ammonium sulphite to sulphate. Thus provision for the production of the final product had been fully made. The theory of this process had apparently been well considered, and was indeed captivating to all interested in the application of chemistry and physics. But the process, at the outset at any rate, suffered the same fate as many other similar processes. Though the originators of it were not likely to abandon it at the first signs of failure, yet, owing to the outbreak of hostilities, only occasional gleanings have leaked through as to the progress made. It is believed, however, the process is now in successful operation at Tegel, in Germany.

The original non-success of the Burkheiser process was due principally to two defects:

(1) So far as the sulphur cycle is concerned, it was found that the introduction of heated air to the purifiers containing FeS, together with free sulphur along with iron oxide, led to the formation of soluble iron salts, such as $FeSO_4$. This fixation of the SO_2 was disastrous from two points of view. It represented the loss of acid gases and inability to regenerate completely oxide of iron, except by special means which were not apparently originally contemplated.

(2) The presence of H_2S in the gases from which ammonia was to be removed by the sulphurous acid solution cited, resulted in the reduction of the H_2S and the precipitation of sulphur in the bath—thus impairing the quality of the ammonium salts produced.

Careful reflection on the various reactions involved in the Burkheiser process certainly leads to the conviction that, by suitable modification, the process could be operated successfully.

One of the directions in which modification will need to proceed is in the removal of the H_2S from the crude gas before absorption in the acid bath is effected. Certain portions of the Burkheiser process can be applied to ordinary gas-works practice. It is conceivable that if ammoniacal liquor were first desulphurized—the sulphur-freed ammoniacal liquor being next distilled to release the ammonia—the latter gas could be absorbed in an acid solution prepared by the absorption of SO_3 in water; the SO_3 being produced by the combustion of spent oxide. In this way there would be no necessity for the expensive Glover and Gay Lussac towers and acid chambers of the sulphuric acid plant. By pursuing this method, saleable ammonium salts could conceivably be made.

However, sufficient has been said to indicate another possible way of utilizing many of the concentrated ammonia liquor plants which have been erected throughout the country.

The writer regrets that the possible disclosure of novel points precludes him from dealing in greater detail with this process. However, curiosity may have been aroused; and as this is one of the forerunners to energetic investigation, probably this somewhat incoherent contribution may serve a useful purpose.

DISCUSSION.

The PRESIDENT (Mr. W. B. Farquhar, of Ilford) said they were indebted to the reader of the paper for a very interesting and illuminating description of this particular subject. The question of liquid purification, with simultaneous recovery of sulphate of ammonia gas, had a certain fascination for gas managers. One of the drawbacks to managers of small and medium-sized works going into this question had been naturally the very expensive character of the plant. The average managers, therefore, had only had the opportunity of seeing plant at the larger works and of gleaning something as to the process; they had had no experience of the actual working. The difficulty with some of these plants was that they required well-trained and specialized individuals to watch continually the various operations as they took place. There were certain temperatures to be observed; and they had to be kept constant. Certain changes had to take place; one vessel had to be turned off, and another put on. So that the smaller works really had no chance of working such processes as these to the same successful end as the larger works. In short, they had not the staff to operate them properly.

Mr. P. G. G. MOON (Bournemouth) said he was sure the members were all agreed that Mr. Parrish was to be congratulated on bringing forward such an interesting paper, as well as upon the very lucid way in which he had presented the chemical and physical laws upon which the application of the process depended. He had made it quite clear that, as a technical process, one could look with certainty to its successful application. When, however, he touched upon the financial aspect, a very different state of affairs might possibly exist. The vision of having to deal with 80,000 gallons of ammoniacal liquor per day instead of 12,000 gallons for a 250-ton works filled one with some amount of apprehension; and one could well understand that a large supply of cheap steam would be necessary in the circumstances. Another point of considerable importance was the factor of safety. When very carefully balanced conditions had to be maintained, the proper maintenance of these conditions was of absolutely essential moment to the successful application of the process; and any failure to keep constant the proper balance would conceivably lead to very serious disaster. What he (Mr. Moon) wished to say more particularly was not so much with regard to this side of the paper (interesting as it was), but with regard to the reference Mr. Parrish made to the Burkheiser process. He hardly thought Mr. Parrish had done justice to the Burkheiser process in his somewhat short remarks at the end of the paper. A year or two before the war broke out, he (Mr. Moon) spent a fortnight in Berlin examining the Burkheiser process as it was then in operation on a ¾ million per day output of gas. It was working quite satisfactorily as an economical process, and indeed as a commercial process it had practically vindicated itself. The description of the process then was hardly (if he might say so) on all-fours with the description as given in the paper; and the reason for its failure—for it certainly had failed—was rather different from either of the two reasons supplied in the paper. With regard to the first reason given for its failure—the formation of iron sulphate in the oxide—there was really no serious trouble on that score, because of the regeneration of the oxide. The temperature was taken to a dull red—sufficiently high to convert any iron sulphate into SO_2, and into monohydrate of iron. Then as to the second reason—H_2S in the gases—as a matter of fact, the crude gas was put through the oxide purifiers first; and therefore the H_2S was removed in the presence of ammonia. The ammonia, however, went forward free from H_2S. The members might be aware that at Bournemouth they put up a 2 million plant; and it was a failure for this reason: In Berlin, the whole successful operation of the Burkheiser process depended upon the particular physical condition of the oxide of iron used. It was in the form of small granules of oxide, very hard and very porous, and about the size of peas. Of course, in testing the process one wanted to know how this oxide was produced. They were assured it could be produced very easily; that they would have enough to supply the requisite amount of oxide at a fixed price. They had to accept the statement. Seeing the oxide was there working, obviously the assumption was that it could be reproduced. It was ascertained that the oxide was made from very hard nodules found in the Silesian oxide fields. By breaking them up and sifting them, the resulting granular mass of oxide was used to fill the purifiers; and it stood successive fouling and regeneration to red heat without breaking-down into dust. When, however, they searched over the Silician oxide fields to get more of these nodules, they could not obtain enough. They searched all the other oxide beds available, and still they could not get any more oxide nodules of the right physical condition. The result was that the stuff they did use at Bournemouth would not stand the repeated fouling and heating. It broke-down into dust. It did not regenerate regularly; and small but fatal difficulties arose. Therefore, although the process was chemically and commercially (apart from this one thing) absolutely proved and successful, yet on this one point it broke-down, and they had to revert to experimenting along lines of having the oxide in suspension in liquid form. With regard to some of the applications of other Burkheiser processes to gas-works conditions, he should like to say that experiments were in hand; and at Bournemouth they were making certain experiments (along the lines suggested at the end of the paper) for Mr. Curphey, the Chief Inspector under the Alkali Works Regulation Act. He could not go into details with regard to them; but he thought it might interest the members to know that experiments were proceeding.

Dr. HAROLD G. COLMAN (London) said this interesting paper by Mr. Parrish could be discussed from a number of points of view. In the first place, perhaps with the feeling they had upon them that day, one might be permitted to think that there was room for another dis-

cussion on the application of science to industry. But they had heard so much about this that it seemed to him the time had come for them not to talk about it, but to get on with such application in actual practice. The subject which Mr. Parrish had brought before them was one which in particular required the collaboration of different forms of knowledge to get either of the processes mentioned to complete success. In this respect, he might make one general statement. In these processes there were three sides concerned—the mechanical side, the chemical and physical side, and the economical side. It was given to only exceptional individuals to be well up in all three branches; and if they were to get forward as they ought to do, it was absolutely essential that they who were mostly ordinary individuals, and more or less one-sided men, should work together in realizing advance. If instead of working together, each of them pushed his own side of the process, irrespective of the other side—if the chemists or physicists pushed, irrespective of the mechanical or the economical side—they were going to get no forwarder; and he trusted that they would all of them, starting as they were on these new advances as from Monday last, push forward together shoulder to shoulder, and always keep in memory the axiom of Euclid, "The whole is greater than its part." The first part of the subject that Mr. Parrish had brought before them had been so clearly presented that he did not think there was much that he could usefully add. What he might have said would be more on minor details, which would not be suitable for discussion there. In reading through the paper, one point did strike him. It was, however, a small matter. In discussing the merits of scrubbers, and in giving a description of the Trepex type of washer, Mr. Parrish had made no reference whatever to the centrifugal vertical scrubbers, which seemed to him (Dr. Colman), and which would be found in many places, the most suitable form yet brought out for the purpose. There was also one other incidental point to which he should like to refer. Mr. Parrish alluded to hydrocyanic acid in the gas, and expressed the view, which he (Dr. Colman) would like very strongly to support, that the removal of hydrocyanic acid from the gas, quite irrespective of any profit, was a matter of great importance to gas engineers. The deleterious effects of hydrocyanic acid were very considerable. Some who had been working concentrated ammonia plants had had large experience of damage from this cause. But, in addition, there was also extensive damage possible, as they knew, later on. Most of them had seen signs of it in their gasholder plates; and it did not stop there. The possibilities of damage went right away into the service-pipes and meters on the district. Here he should have to differ from Dr. Lessing to some extent; or rather he did not think he differed, but he had some addition to make to a point Dr. Lessing had lately advanced in this respect. In regard to the corrosion which had taken place in service-pipes and meters, Dr. Lessing had suggested that the deposit which was found there consisted of spent oxide carried forward mechanically from the purifiers.

Dr. LESSING: Some of it.

Dr. COLMAN said he quite admitted it might be so in some cases, though he had not himself actually come across it. But he could say positively that there were many cases in which the deposit which was formed in service-pipes (which in certain works in this country had become a serious nuisance) was assuredly not due to this cause. It was brought about by the corrosion which was set up by the hydrocyanic acid and the oxygen present in the gas distributed. Evidence that this was not spent oxide carried forward was found in the analysis of the deposit itself. Certainly, the corrosion often resembled spent oxide in appearance; and it contained the same constituents. But the quantitative composition of the material was totally different from spent oxide. Whereas spent oxide (one might take it) on the average contained 25 p.ct. of sulphur as the gas left it—sometimes it might be as much as 50 p.ct., sometimes as low as 5 p.ct., or almost none, but the average would be about 25 p.ct.—he had never found in these deposits more than 3 p.ct. of sulphur. Whereas the sulphur in spent oxide was present in greater quantity than prussian blue, in these deposits in the service-pipes prussian blue might amount to six times that of the sulphur. He had two analyses which he would write on the blackboard. These were as follows:

Analysis of Deposits from Service Pipes.

	(1) Per Cent.		(2) Per Cent.
Loss at 100° C.	5·45	..	4·60
Further loss on ignition	26·12	..	19·55
Total ferric oxide (Fe_2O_3)	66·23	..	72·00
Ferric oxide, excluding iron present as prussian blue	60·62	..	68·94
Prussian blue (Fe_7Cy_{18})	12·77	..	4·70
Amm. sulphocyanide (NH_4CNS)	0·37	..	0·23
Free sulphur	2·05	..	3·10
Sulphur as sulphate	*	..	0·40
Alumina (Al_2O_3)	*	..	0·10

[* Not determained.]

It would be seen that in No. 1 the percentage of prussian blue ran up as high as nearly 13 p.ct., and the free sulphur was only 2 p.ct. In the second one, the prussian blue was only 4·7 p.ct. Still the sulphur was only 3·1 p.ct. In none of these cases could he find evidence of any organic matter other than that taken up from the gas. He also determined the alumina; for, if the deposit were ordinary oxide, there would be a considerable amount of alumina present. In many cases, where serious corrosion had been going on, it was due to the hydrocyanic acid; and the damage it did proceeded slowly; and only made itself manifest after a long time. If this was to be prevented, it seemed to him that the hydrocyanic acid should be removed in some way or another, whether or not it formed a direct source of revenue. With regard to the second part of the paper, Mr. Moon had made some remarks similar to those that he (Dr. Colman) had in mind. He would therefore not repeat them. But he should like to say that the Burkheiser plant was being worked not only in Germany, but in this country, though he was not at present in a position to give any information in regard to it. One other point. Mr. Parrish had not referred to the direct manufacture of sulphate, utilizing the sulphur present in the crude gas, by the Feld polythianate process. He understood the Feld process had been largely worked in Germany during the last four years. This had been stated in a French publication; and it was exceedingly likely. Germany had probably not only got its sulphate of ammonia from the coke-ovens without the use of sulphuric acid, but it had evidently got the excess sulphur to use for making sulphuric acid for other purposes. He had no doubt in his own mind that eventually some process would be worked out by which sulphate of ammonia could be directly produced, utilizing the sulphuretted hydrogen in the crude gas. But, naturally, all such processes took time, and the road to success must inevitably be marked by partial failures, out of which eventually a successful process was evolved.

Dr. LESSING (London) said it was rarely he disagreed with his friend Dr. Colman; and even in this case there was no cause for disagreement in their opinion, because, in the first instance, he should like, if he could, to accentuate his plea for as complete removal as possible of the cyanogen from the gas. He fully endorsed Dr. Colman's views that this was absolutely essential; and he further believed that in future they would extract all the cyanogen present in the gas, even if it was not for any economic purpose, but only in order to remove a detrimental substance from the gas. In connection with the points mentioned by Dr. Colman, his own experience could corroborate the view that cyanogen in one form or another did go right up to the service-pipes and meters; and there was hardly a meter which had been sent in for repair, and which he had tested, in which cyanogen compounds had not been found to a certain extent. The cyanides, or some of them, were probably produced, as Mr. Taplay had shown in his recent paper before the Institution of Gas Engineers, and as he (Dr. Lessing) foreshadowed quite casually two years ago, by the interaction of ammonia and carbon bisulphide; and traces went right up to the consumers' meters. The difficulty in connection with the spent oxide carried forward was that, when it was carried forward, it was still subjected to the influence of the cyanogen or other compounds present in the gas. The fouling action in this case, the combining action with cyanogen, rather preponderated as against sulphuretted hydrogen, because the latter had been much more completely extracted in the purifiers. In the report which he made some time ago he quoted two analyses of deposits which he had found in meters, and which he at that time could pronounce (from the analysis) as oxide. On the other hand, he had found large quantities of oxide in certain cases with sawdust or other organic matter still mixed with it in mains and service-pipes. However, he must say that the extraction of the cyanogen was a most important matter (and in future would be considered as important as sixty years ago the extraction of tar was considered to be) in a process of the kind Mr. Parrish had put forward. In the paper, Mr. Parrish mentioned particularly the Williams process, which was running very successfully in a number of cases, also the Davis-Neill process. He (Dr. Lessing) had the good fortune to introduce one process for cyanogen extraction some years ago which was not unlike the Davis-Neill, and in which ammonia was used in place of an alkali. This process admitted of one aspect which might be considered useful in connection with the proposal which the members were discussing that day—that was, the preparation of the iron sludge by means of the ammonia that was present in the gas. This could quite easily be done by simply scrubbing the gas in the final scrubber with a solution of ferrous sulphate. By doing this, the last traces of ammonia were arrested in a more efficient manner than it could be otherwise. Dr. Davidson some years ago, before leaving Birmingham, worked on liquid purification, and some work he believed was still being done there. But Dr. Davidson himself was very interested in this part of his (Dr. Lessing's) proposal; and he meant to adopt it. He did not know whether Dr. Davidson's successor had followed up the suggestion. He (the speaker) proposed to put in after the final scrubber a sulphate of iron scrubber. Not only did this very effectually remove the last traces of ammonia in the gas, but it permitted of the working-up of the aqueous ammoniacal liquor to a higher concentration, because, with the slip that was permissible in this case, they could work the liquor to a high concentration. Even if a considerable amount of ammonia was going forward, it was bound in the end to be caught in this ferrous sulphate. It could be done. Therefore it was possible that the 80,000 gallons of liquor mentioned in the paper, and on which Mr. Moon looked with some apprehension, on account of the steam that would have to be supplied for dealing with it, would be reduced to a very considerable extent. He was not able, on the spur of the moment to say by how much; but one thing was certain, that a highly concentrated liquor could be produced. One other point with regard to the notes in the paper on the difference of film action and bubbling action. In the Trepex washer which Mr. Parrish proposed, he (Dr. Lessing) presumed he got a fog very much of the kind that was obtained in the centrifugal washer that Dr. Colman had mentioned. The action of bubbling did not take place quite to the extent that they would expect in the Livesey washer. Therefore pressure differences could not be observed any more than they would be with the film action in a scrubber packed with efficient filling material. Could Mr. Parrish tell them whether he had any theory by which he could explain the difference in the action of what might be called a continuous film and of a great number of globules of liquid fog?

Mr. THOMAS GLOVER (Norwich) asked if the dissociation of the ammonia, sulphuretted hydrogen, and carbonic acid gas had ever been attempted under a *minus* pressure. Mr. Parrish mentioned so many inches of mercury pressure. It occurred to him (Mr. Glover)—it was not entirely his own idea—that loss of ammonia was occasioned by having to work at such temperatures that ammonia went forward with sulphuretted hydrogen and carbonic acid gas. If the dissociation could be carried out at a low temperature, there would be much less risk of loss resulting. While on his feet he would like to say how much they were indebted to gentlemen like Mr. Parrish, who was evidently a good chemist and a good physicist, and was in the position to carry out these important experiments. They were also indebted to his Company for allowing the paper to be read descriptive of experiments on the big scale which were manifestly going on in the spirit of the times. It was very important that large companies who had money to spend, and especially when the expenditure of sums such as were involved here would not affect the price of gas by a fraction of a penny, should carry out experiments with their trained staffs, and ultimately give the industry the benefit of the results. He believed it was the President who said this was a "fascinating" subject. It was.

That the crude gas contained within itself the elements for its own purification was an attractive thing; but the final product they had to supply to the consumers was so well defined that the sending forward of sulphuretted hydrogen would likely lead them into great trouble with the consumers. In his opinion, anyone proposing to experiment with liquid purification in closed vessels would do well to do it on the inlet of the purifiers. [Laughter.] And, when all was said and done, it would probably be found that they might just as well perform the whole thing with solid material, and make a little profit out of it as some were doing already, and not involve themselves in big plant, delicate operations, and an expensive staff to watch the operations.

Mr. PARRISH, in reply, warmly thanked the members for the kind way in which they had received the paper. It was only a tentative paper. It was obviously written with a number of loopholes in it, so as to evoke a good discussion. He was pleased, indeed, that he had prepared the paper, because the remarks of Mr. Moon and the comments of Dr. Colman and Dr. Lessing had really added something to their knowledge of the subject. Therefore, if only for the discussion it had evoked, it had certainly served some useful purpose. The President in his observations on the plant referred to its expensive nature. He (Mr. Parrish) was not at all so sure that the plant which he had outlined in the paper would, after all, be any more expensive than a series of purifiers for solid purification, presuming new gas-works were being started. Mr. Moon raised a point which appeared to suggest that he (Mr. Parrish) was an individual who could bring before the members a beautiful portraiture of some process of technical interest, and altogether overlook the important aspect of finance. He could only say that Mr. Moon had fallen into one of the traps that he set in the paper to catch the unwary. His (Mr. Parrish's) training had been directed in such a way as to first of all concentrate principally on the financial aspect. Invariably in working out a process, with the view to starting it constructively, he had always looked at the financial side before making recommendations, seeing that the financial aspect was an important factor in success. Therefore, he had not overlooked, even though he might have burked in the paper, the financial aspect of liquid purification. Mr. Moon's point (which was quite a good one) was disposed of when it was remembered that in the paper he repeatedly referred to 80,000 gallons of ammoniacal liquor as the equivalent of 80,000 gallons. But by the operation of the dissociating and distilling plant which he had recommended, it was possible to obtain a concentration of about 6 p.ct. of ammonia. Therefore the amount of liquor involved was only something of the order of 19,000 gallons to distil. Hence this appreciably affected the economic aspect. He might say he had occasion to make some experiments two years ago concerning the consumption of steam used in decomposing and ammonia (fixed and free) stills—indeed, a complete thermal balance-sheet—and as the data constituted the basis of determining the success or otherwise of the process with which they were dealing that day, it would, perhaps, be interesting to give the figures. There was no attempt made in the decomposing section of the plant to take advantage of the heat of interchange in these experiments; the interchange heat was valuable in certain operations of the plant, and could, without difficulty, be utilized. It was found that 5 lbs. of steam was necessary per 100 lbs. of liquor, in order to effect complete dissociation of the ammoniacal liquor, and such ammoniacal liquor was sent forward at a temperature approaching 215° Fahr. The consumption of steam in the ordinary stills (free and fixed together) of the sulphate of ammonia type was 21 p.ct. So in all they had 26 p.ct. consumption of steam in the desulphurization and decarbonization of the ammoniacal liquor and the release of the ammonia from the caustic ammoniacal liquor. If they took a loss of 2 p.ct. (because very few sulphate of ammonia plants were conducted at a greater efficiency than 95 p.ct.), he was quite satisfied from extended experience that the desulphurization and the release of the ammonia could be conducted at 93 p.ct. efficiency. Basing on the 2 p.ct. loss incurred by reason of the operation of the ammonia purification plant, and taking into consideration the relatively rather larger quantity of liquor that was being distilled, and drawing up a balance-sheet for the purpose, taking into account the 26 lbs. per 100 lbs. of ammoniacal liquor, they would find there was very little difference between the cost of liquid purification and the cost which was being incurred at the moment in purifying crude gas by oxide of iron. He was basing on 4d. per 1000 c.ft. for the latter. He quite agreed with Mr. Moon with regard to the factor of safety, and the necessity for extreme care in control. Reference to his paper would show that he made no allusion whatever to the method by which the various washer-scrubbers could be operated. It was quite conceivable that all sorts of safety measures could be pursued, with the view of removing the last traces of both the ammonia and the sulphuretted hydrogen, &c. There was no necessity to take the whole of the gaseous ammonia into No. 1 washer-scrubber. A proportion could go forward to No. 4 or No. 5, and could act in the promotion of the reactions represented in the paper. On this score, Dr. Lessing pointed out that he had suggested to Dr. Davidson, of Birmingham—he (Mr. Parrish) believed the suggestion was carried out—that sulphate of iron should be introduced into the last washer-scrubber in order to complete the elimination of traces of H_2S, and then presumably the iron sludge was to be brought to the cyanide washer-scrubber in order to eliminate the hydrocyanic acid. In this way they got a mixed solution of ferrous carbonate and ferrous sulphide eliminating the hydrocyanic acid, as entirely distinct from the ferrous carbonate in the Davis-Neill process. The efficiency of the elimination of the HCN was practically identical. One point in Mr. Moon's remarks, he (Mr. Parrish) failed to appreciate completely. Might he ask, in connection with the ammoniacal liquor which was formed in the hydraulic main and the condenser when operating the Burkheiser process, whether the liquor was distilled and sent to the sulphurous acid saturator?

Mr. MOON: We distil it into the inlet of the purifiers.

Mr. PARRISH: I had occasion to examine some of your sulphate; it contained a great deal of free sulphur.

Mr. MOON: The cause was improper control of the revivification.

Mr. PARRISH said his paper was based essentially on the original plant as operated at Skelmanthorpe. There was undoubtedly a reduction of H_2S by the sulphurous acid and the deposition of free sulphur. Of this he was quite certain. He had been very interested in the remarks of Dr. Colman; and he need scarcely say he fully endorsed what he had said with regard to the judicious combination of chemists and physicists and engineers, and the man responsible for overlooking the costs of the proposed new processes. He was quite certain that, unless the industry was prepared to move on scientific lines during this reconstruction period, it would find itself placed in a very difficult position. What the Germans had accomplished during the war in scientific matters was really astounding. If they only turned to the organic world to see what had been done, they would find all sorts of devices (such as had never been conceived before) had been adopted in the manufacture of various products, due to the absence of raw materials to which the ordinary chemist had recourse. The fact that the Germans were unable to get pyrites either from Spain or Norway did not deter them from making oleum. All they did was to get the natural gypsum, distil it, and convert it by the ordinary catalytic processes. He was certain that if the country was only *au fait* with the strenuous efforts put forward by the Germans scientifically, they would not resort to boisterous rejoicing, but rather to thanksgiving for the triumph the Allies had obtained. As regards the relative advantages or disadvantages of the Trepex scrubber over the centrifugal scrubber, he held no brief for the former. But he thought if it were devised in the way he suggested, with a definite seal, and then with a splasher arrangement as well—so that they could incorporate a film contact, as well as actual bubbling in a compact apparatus—two very desirable mechanical operations were attained. Concerning the Feld process, it would have given him pleasure to have referred to it; but he really had no opportunity owing to the already great length of the paper. He did indicate to the Hon. Secretary his intention of dealing with the direct recovery of ammonia by the sulphuric acid washer and several of the neutralizing processes which had been devised for preparing neutral sulphate of ammonia. But owing to want of time he had to disregard these various aspects. As to the question asked by Dr. Lessing with reference to a continuous film and a large number of globules, he had not been able to express his experience mathematically as yet; but he found, in connection with the concentratration of sulphuric acid by means of the Kessler process, they did get a very efficient concentration of sulphuric acid when they adopted the Kessler type of *plateau* such as was originally devised than they did by the Perrin type of *plateau* arrangement, where the actual contact was merely of a film nature. In other types of plant, for example, in arresting ammonia which was released in the dissociation process, it was better to adopt an apparatus which incorporated the principle of the Livesey washer than to have film contact, as was the case by adopting ordinary tower scrubbers with the wooden mediums with which they were filled. Mr. Glover raised a rather important point, and asked whether he (Mr. Parrish) had had any experience with the operation of decomposing plant with *minus* pressure. He had; and it certainly facilitated the dissociation of the gas liquor—both the hydrosulphate, the sulphide, the carbonate, and the bicarbonate. But the absorption afterwards of the ammonia was not quite so good.

Mr. GLOVER: It should be done under pressure, of course; but not a considerable pressure I take it.

Mr. PARRISH said the difficulty was in synchronizing the two operations where they had a vessel under a vacuum and the other where they had to work under a pressure. It seemed to necessitate the interposition of an exhauster to create a vacuum on the dissociator and a pressure in the absorber, and this had to be looked at from a financial point of view. He should also like to dispose of Mr. Glover's lugubrious apprehension as to the efficacy of liquid purification. He (Mr. Parrish) was certain if the process was adopted and scientifically controlled, there was no fear of sulphuretted hydrogen getting out into the district, as the caustic ammonia solutions, along with the other safety measures capable of ready application, were more susceptible to the elimination of traces of H_2S than was the case with oxide of iron.

On the invitation of the PRESIDENT, the members passed a very hearty vote of thanks to Mr. Parrish.

Portable Conveyors for Coal and Coke Handling.

An illustrated account appears in the American "Gas Age" of the use by the Western United Gas and Electric Company, in connection with their station at Joliet (Ill.), of two portable belt conveyors made by the Barber-Green Company, of Aurora (Ill.), which are operated in series for loading coke into railway cars. These cars are loaded in from two to four hours, according to size and type, with less than one-half the labour that was previously required to load them in from seven to ten hours. The saving in cost is about 50 p.ct. High wages and the depleted labour market were really responsible for the attention that has lately been given to the design of conveyors of this kind, which, it is said, in hundreds of instances have proved their ability to reduce handling costs from 50 to 90 p.ct. Single units have replaced from three to twenty men. They were so badly needed that they have paid for themselves, in many cases, in less than a month. Portable belt conveyors of the type referred to elevate as well as move material, and so have made it possible to utilize more fully the storage space available. Without additional cost, material can be piled to the top of a coal-shed; and on the open ground higher and more compact piling of material is possible. The Company named have worked out several patterns of conveyors to meet different requirements. For elevating at angles under 25°, a plain belt is employed; while for angles of 30° to 35°, a belt equipped with steel flights is provided, to prevent the material slipping down. The conveyors are made portable by mounting them on a wheeled track or suspending them from a trolley attached to an overhead steel cable,

THE INSTITUTION OF GAS ENGINEERS.

REFRACTORY MATERIALS COMMITTEE.

Report on the "Corrosive Action of Flue Dust on Fire-Bricks," by Dr. J. W. MELLOR.

[The Committee intimate that the experiments indicated in this report were conducted by Mr. Walter Emery; and they are indebte d to Dr. A. Scott for the microscopic work.]

The influence of the various conditions, liable to obtain in industrial furnaces, on the refractories is of the greatest importance. It is so difficult to study these effects on big-scale plant under working conditions that very few useful observations have been recorded; and in many cases contradictory or cross results are alone available. There are several explanations for this. It is not always easy to recognize an abnormal condition, because this condition may prevail for a limited period, without making itself obtrusive; but it may perhaps continue long enough to injure seriously the refractory. The abnormal condition may not have been noticed (it is not always easy to see the obvious); and the verdict of the fireman, stoker, or engineer-in-charge is that "everything has been conducted exactly as before." The only possible explanation of the trouble is that the refractories are thoroughly bad. Many specific examples come to mind where failures have not been the fault of the refractory; though there are other examples where the refractory is itself to blame.

The following experiments describe an attempt to produce abnormal and deleterious conditions. The only possible way to get information on this subject is the method of trial and failure. Experiments must be conducted where every baneful condition is under control.

We are here concerned with the action of corrosive flue dust on refractories. The abrasive action of dusts will be discussed in the next report, which is almost ready. There are many sources of dust in furnaces—coal-ash from the producers, dust from furnace charges, &c. It is even possible for the action to take place inside a gas-retort when the coal is mixed with a relatively minute proportion of limestone. There are two types of limestone—one type is very prone to spurt or decrepitate when heated; the other type is still. If the former type be rapidly heated in an open crucible on a triangle, a ring of white dust will usually be formed on the bench about the feet of the tripod support. If the spurting type of limestone be mixed with the coal, a little lime is carried along with the escaping gas; and this readily attacks the inner walls, producing a glazed surface. This repeated, charge after charge, may shorten the life of a retort very much.

THE FURNACE.

The furnace employed enabled bricks to be exposed to the action of flue-dust at a high temperature under conditions where the time of heating, the nature of the flue-dust, the speed of the flue-dust, and the atmosphere (whether oxidizing or reducing) are under control.

The gas furnace is heated by means of a Brayshaw burner, using a blast of 3 lbs. to 4 lbs. pressure (provided by a rotary blower) and town gas at a main pressure of 3 in. to 4 in. The internal chamber is 18 in. high, 18 in. wide, and 9 in. from back to front. The air and gas are preheated by an auxiliary burner fixed at the back of the furnace. A thermocouple is inserted in the air-pipe to indicate the temperature of the blast, which is usually between 350° and 400° C. A tube runs down the centre of the burner; and the upper end of the tube is connected with the dust-feeding hopper on the top of the furnace. The hopper is fitted with an internal screw-controlled cone regulated by a small hand wheel, the operation of which allows the dust to be admitted to the burner at any desired rate. The incoming stream of air and gas sucks the dust down with it; and thus the flame, with its accompanying dust, is projected downwards on to the surface of the brick. A glass tube connected with the stem of the funnel enables the operator to see if the stream of dust is working satisfactorily. The furnace was constructed by Messrs. Brayshaw, of Manchester.

The bricks are placed at a fixed distance from the tip of the burner. The temperature can be steadily raised until the desired temperature is reached. The measurement is made by an optical pyrometer (Fèry). The maximum temperature desired is maintained for half-an-hour before the flue-dust under investigation is fed into the burner at the desired speed. The rate of feeding is easily regulated by a screw at the top. When a given amount of flue-dust has been driven on to the refractory, the temperature is kept constant for a further period of half-an-hour.

The following require special attention: (i.) The distance the brick is placed away from the burner; (ii.) the rate of heating; (iii.) the maximum temperature reached; (iv.) the period of time the brick is exposed to the maximum temperature before the dust is allowed to enter; (v.) the amount of dust; (vi.) the rate at which the dust is fed on to the brick; and (vii.) the time the brick is kept heated after the dust has all been used.

In this furnace the attempt is made to treat a brick so severely that results will be obtained in a few hours which might require months to produce in industrial furnaces. The brevity of life renders it necessary to accelerate the results in this manner, in order to satisfy the appetites of committees for reports, and to enable the investigator to see some results before passing his work on to the next generation. No harm is done, provided the difference in the conditions with the accelerated results be constantly borne in mind.

FLUE DUST.

In the series of experiments now to be described the following types of dust were employed: (1) Boiler flue dust of a slate-brown colour. (2) Boiler flue dust of a brown colour. (3) Deep red-coloured dust from the top of the retort-bench of a gas-works. (4) Dust from the slag-chamber between a steel-smelting furnace and the regenerator. (5) Dust from a blast-furnace Cowper stove. (6) Bull dog. (7) Red hematite ore. (8) Top cinder. (9) Lime from calcined marble. (10) Lime and common salt—half-and-half. (11) Salt. (12) Sodium sulphate. (13) Salt and potash spar—half-and-half. (14) Sodium silicate and calcium silicate—half-and-half.

Analyses of most of these dusts are indicated in Table I.

The dusts were all lawned or sieved; and only the fraction passing the 60's lawn was used. It was necessary to grind some of the material before lawning—*e.g.*, bull dog. In each test, 120 grms. of dust were used.

In order to find a suitable comparison temperature for testing the corrosive action of the flue-dusts, the bricks A and B were separately tested with dusts Nos. 1, 2, 3, and 9 at temperatures 1100°, 1200°, 1300°, and 1400° C. The tests were conducted as indicated above. The results of the tests with Brick B are indicated in Table II. Similar remarks apply to Brick A.

TABLE II.

Material.	At 1100°.	At 1200°.	At 1300°.	At 1400°.
1	Powder just adherent	Bloated vesicular mass	Fluid mass	Very fluid; slight corrosion
2	Powder just adherent	Powder	Semifluid mass	Fluid; no corrosion
3	Sintering just commenced	Melting down	Fused; no corrosion	Slight corrosion and penetration
9	Dry powder	Slightly melted	Fused; slight corrosion	Surface badly corroded

There is no way of indicating the effects of the dust by measurement and four photographs were used to illustrate the action upon the surface.

At temperatures below 1300° C., the action of the dust is mechanical rather than chemical. The dust begins to act chemically at some temperature exceeding 1300° C. Obviously, each dust will have its own critical temperature, and should be studied as an

TABLE I.—ANALYSES OF FLUE DUSTS.

—	1	2	3	4	5	6	7	8
Silica, SiO_2	18·33	44·98	20·40	28·76	13·76	15·60	6·80	3·05
Titanic oxide, TiO_2	n.d.	0·82	0·67	0 61	0·13	n.d.	n.d.	n.d.
Alumina, Al_2O_3	2·92	9·50	10·07	8·32	7·12	0·68	1·40	0·35
Ferric oxide, Fe_2O_3	45·34	32·38	55·86	43·60	26·60	8·76	89·94	25·86
Manganese oxide, MnO	n.d.	n.d.	n.d.	0·99	2·08	n.d.	n.d.	1·40
Magnesia, MgO	2·26	1·18	0·55	0·83	2·16	0·85	trace	0·40
Lime, CaO	12·48	3·54	2·25	10·92	9·10	1·30	0·96	0·26
Potash, K_2O	1·40	3·62	2·60	1·74	6·61	*nil*	0·33	*nil*
Soda, Na_2O	1·30	0·32	0·74	0·32	1·66	*nil*		*nil*
Loss on ignition	4·21	3·51	3·84	0·72	8·32	*nil*	*nil*	*nil*
Phosphoric oxide, P_2O_5	n.d.	n.d.	n.d.	3·32	1·26	6·42	0·05	0·87
Sulphur trioxide, SO_3	11·62	n.d.	3·31	n.d.	6·48	0·62	n.d.	n.d.
Zinc oxide, ZnO	*nil*	*nil*	*nil*	*nil*	15·49	*nil*	*nil*	*nil*
Ferrous oxide, FeO	n.d.	n.d.	n.d.	n.d.	n.d.	65·32	n.d.	67·46

individual. In this preliminary survey, the temperature was kept at 1400° C.

Fire-Bricks.

The analyses of the fire-bricks are indicated in Table III.

TABLE III.—ANALYSES OF THE FIRE-BRICKS.

——	A	B	C	D	E
Silica SiO_2	62·00	66·81	94·34	93·52	93·66
Titanic oxide, TiO_2	1·09	1·52	0·36	0·36	0·26
Alumina, Al_2O_3	31·72	27·38	1·96	2·87	2·10
Ferric oxide, Fe_2O_3	3·89	2·19	0·83	0·22	1·30
Magnesia, MgO	0·42	0·35	0·06	0·26	0·06
Lime, CaO	0·47	0·22	2·04	2·50	1·44
Potash, K_2O	0·40	1·06	0·28	0·46	0·60
Soda, Na_2O	0·21	0·69	0·21		0·42
Loss on ignition	—	0·17	0·12	0·26	0·22

A was a typical fireclay fire-brick. The grog fragments were of medium size (2 to 3 mm. diameter), and very hard and compact. The texture was moderately close; but occasionally the cohesion between grog and bond was not particularly good. Some of the bricks had not been well made, as they occasionally showed signs of lamination.

B was a typical fireclay fire-brick. The grog was coarser than in A (3 to 4 mm. diameter). The texture was much more open, and the grog fragments more easily detachable from the bond. B had probably been fired at a lower temperature than A.

C was a silica brick with fairly coarse grains (up to 6 mm. diameter). The texture was somewhat open, and by no means uniform, and the larger grains were often easily detachable from the bond.

D was a very fine grained silica brick; and the grains were of a uniformly small size. The texture was uniform, but not very close; and the bond was not particularly good, as the brick tended to crumble to fragments under pressure.

E was a close-grained, dense silica brick with medium grains (up to 3 to 4 mm. diameter). The larger grains were not easily detachable; and, as was to be expected from the close texture, the fracture was fairly smooth.

The term erosion is conveniently applied to the cutting or abrasive action of a dust [to be discussed in a later report], and corrosion refers to the solvent action of the fused dust on the brick. Severe corrosion is, therefore, equivalent to slagging. Except where mentioned, the temperature was 1400° C.

RESULTS WITH DUST NO. 1.

Bricks A and B.—The dust has reacted to some extent with the material of the brick, which is fluxed on the surface. The average depth of penetration is about 1 cm., while the corrosion both of grog and bond is appreciable.

RESULTS WITH DUST NO. 2.

Bricks A and B.—The dust has melted to a glass on the surface, but has not in either case penetrated the bricks to a greater depth than 0·3 cm.; nor is there any appreciable corrosion.

RESULTS WITH DUST NO. 3.

Brick B.—The upper surface of the brick is glazed, and has been corroded to some extent; there is also considerable cracking. In cross-section, it is seen that the dust has penetrated completely through the brick. The grog has suffered little attack; but the bond is permeated with the dust—the upper layers having melted.

Brick C.—The upper surface is much corroded, but the attack has been confined mainly to the bond; and the larger grains stood out in relief. The average depth to which the dust has penetrated is 2·5 c.m.

MICRO-EXAMINATION.—The dust is confined to the matrix, which has apparently been molten. It consists of cristobalite, magnetite skeletons, and minute crystals, which are probably rich in silicate of iron. The larger rock fragments have been attacked round the margins; but there is no evidence of penetration of the dust through the fragments. The greater proportion of the quartz in the latter has been converted to cristobalite, as there is, on an average, only 12 p.ct. of residual quartz (all in the fragments) in the brick; the quantity before the flue attack being about 45 p.ct.

RESULTS WITH DUST NO. 4.

Brick A.—The surface is glazed with slight corrosion; while "runnels" have developed down the sides. The average depth of penetration is 4 cm. The larger grains have been attacked; but are still distinguishable. The extent to which the dust has penetrated could not be exactly determined.

Brick C.—The boundary between the attacked and unattacked parts is sharply defined; the average depth of penetration being 2·2 c.m. The larger grains stand out in relief, and are apparently unattacked; but the upper surface has been corroded.

MICRO-EXAMINATION.—The micro-examination of the upper surface shows that the brick has there been melted completely, as no trace of the rock fragments remains; the whole being a uniform mass of cristobalite, with some tridymite, brown to black skeleton crystals, and brown opaque glass. In the greater part of the attacked area the larger grains, though completely converted to cristobalite, can be clearly distinguished, and are apparently free from foreign material. They have been attacked round the margins, however, as they are generally bordered by an aggregate of skeletal black crystals and cristobalite, arranged in a radial fashion. Beyond this is the brown glass of the matrix, which in places has apparently crystallized.

RESULTS WITH DUST NO. 5.

Brick B.—The surface is glazed, and has suffered corrosion. The dust has penetrated completely through the brick; and apparently both bond and grog have been attacked.

Brick C.—Some corrosion has occurred on the upper surface; but the larger grains are apparently unattacked, and stand out in relief. The average depth of penetration is 3 cm.

MICRO-EXAMINATION.—Micro-examination shows that the effect has been similar to that of dust No. 4 on brick C. The dust has reacted with the matrix, which has been completely re-crystallized. The larger grain still contains about 12 to 15 p.ct. of unconverted quartz, which is generally the cores of the original quartz crystals. The larger grains have been attacked round the margins; and in some cases the dust has also penetrated them—being distributed through them in a reticulate fashion, the network possibly having some connection with the structure of the original rock.

RESULTS WITH DUST NO. 6.

Brick C.—The upper surface has been corroded, leaving the larger grains in relief. The average penetration is 2·2 cm.

MICRO-EXAMINATION.—The magnetite is confined to a matrix; and there is no evidence of reaction between it and silica. The unchanged quartz is 45 p.ct., which indicates that little conversion has occurred during treatment.

Brick E.—There is some corrosion on the upper surface; but the larger grains and bond have been corroded uniformly. The average penetration is 2·2 cm.

MICRO-EXAMINATION.—The magnetite is confined to the matrix; but considerable conversion of the quartz in the larger grains has occurred, as the residual amount is as low as 30 p.ct. Some slight reaction between Fe_3O_4 and the brick has occurred.

RESULTS WITH DUST NO. 7.

Brick C.—The upper surface has been corroded; but the large grains are almost untouched, as they are white and sharply defined against the black bond. The average penetration is 1·6 cm.

MICRO-EXAMINATION.—The dust has penetrated the matrix, with which it has reacted, forming fayalite (ferrous orthosilicate). The larger grains have not been penetrated by the dust, nor has much further conversion of the quartz occurred, as there is often 80 p.ct. of residual quartz in the fragments.

Brick D.—Comparatively slight corrosion has occurred; and the dust has penetrated to an average depth of 0·8 cm. In the attacked portion the larger grains cannot be distinguished.

MICRO-EXAMINATION.—In thin section, under the microscope, the iron oxide is seen to have penetrated everywhere—large grains as well as matrix, and to have reacted with the quartz to form ferrous silicate. In the matrix there is an average of 7 p.ct. of residual quartz; in the larger grains, about 30 p.ct. This indicates that much conversion has occurred during the attack.

RESULTS WITH DUST NO. 8.

Brick A.—Surface shows great amount of corrosion, much the greatest in the series. The grog has apparently not been directly attacked, but has been cut away through; the surrounding body being attacked. The average depth of the penetration is about 3 cm.

Brick C.—The upper surface has been corroded, and the larger grains are in relief. The average depth to which the dust has penetrated is 3 cm.

MICRO-EXAMINATION.—The dust has penetrated the matrix, which has probably been completely fused, as it is an aggregate of cristobalite with some well-formed tridymite, magnetite, and fayalite. The larger grains show reaction rims round the margins; but there has been little apparent penetration. The amount of residual quartz in the large grains has been reduced from over 80 p.ct. to about 50 p,ct.

Brick D.—A uniform corrosion of the upper surface has occurred. The average depth to which the dust has penetrated is 2·1 cm.

MICRO-EXAMINATION.—Under the microscope the larger grains are seen to have to a great extent lost their individuality, and the dust has penetrated everywhere. The amount of quartz has been reduced to 25 p.ct.; and each quartz grain is isolated in a matrix which has been completely altered to an aggregate of tridymite, cristobalite, magnetite, and fayalite. There is a reaction rim round each quartz crystal, which represents the core of an original quartz grain.

RESULTS WITH DUST NO. 9.

Brick A.—The surface has been glazed and corroded to some extent. The average depth of penetration is 1·5 cm. The grog has only been attacked on the margins of the fragments; and the penetration has been mainly by way of the bond.

Brick C.—The upper surface has been corroded, leaving the larger grains in relief on a glazed surface. The average depth of penetration is 1·6 cm.

MICRO-EXAMINATION.—No quartz is left in the matrix, which consists of cristobalite, tridymite, and a third mineral which is too minute for identification. The matrix has probably been molten. The proportion of unaltered quartz in the large grains varies from 20 to 45 p.ct.; but the mean is about 32 p.ct. Each residual quartz crystal (which is small) is the core of an original crystal. The larger grains are easily recognizable, as the boundaries are sharp. The lime has reacted first with the matrix, the whole has melted, and the cristobalite has crystallized-out on cooling. There has also been reaction between the lime and the larger grains; but this seems to have occurred along the boundaries of the original quartz-grains—*i.e.*, along lines of the cementing material. Over the whole brick, the proportion of quartz has been reduced from about 50 p.ct. to approximately 12 p.ct.

RESULTS WITH DUST NO. 10.

The temperature in this case was 1480° C.

Brick A.—The surface has undergone very considerable corrosion, and the grog stands out in relief. The average depth of

penetration is 1·8 cm. The bond has been fluxed; and consequently the grog has been detached.

Brick C.—The surface is glazed with the larger grains in relief. The penetration amounts, on an average, to about 0·8 cm. The bond has been attacked and fluxed; but the larger grains, while they may have been corroded round their margins, are otherwise unattacked.

RESULTS WITH DUST No. 11.

Brick A.—The surface is glazed; but there is little corrosion. The average depth of the attack is about 2·5 cm. The grog is apparently untouched.

Brick C.—The surface has been glazed and the bond fused. But the larger grains have not been attacked; and they stand out in relief on the corroded surface. The penetration is slight—amounting to 0·4 cm.

RESULTS WITH DUST No. 12.

Brick A.—The surface is glazed; but there has been little corrosion. The grog and bond have been attacked uniformly. The average depth of penetration is about 1 cm.

Brick C.—The upper surface is strongly attacked; but the salt has not penetrated more than 0·5 cm. The larger grains stand out in relief, and are coated with a glaze.

MICRO-EXAMINATION.—The larger grains have not been attacked to any great extent, as they still contain about 80 p.ct. of quartz. The brick, as a whole, has still 40 p.ct. Any attack which has occurred is round the margins of crystal grains. The matrix has melted to a glass from which cristobalite and a silicate—presumably sodium—have crystallized-out to some extent. Some of the cristobalite probably developed during heating, as it is in the form of "large" round crystals—the remainder, which is skeletal, developed during cooling. At the edge the larger grains have been attacked, as the boundaries have disappeared, and the proportion of quartz gone down to 30 p.ct.

RESULTS WITH DUST No. 13.

Brick A.—The upper surface is glazed; but there has been no corrosion. This surface seems to have had a protective action, as the penetration has been slight—averaging 0·6 cm. The grog is unattacked; but the bond has reacted with the dust to form a glass.

Brick C.—The upper surface is well glazed; but there has been little penetration into the interior. The bond has first been attacked; and the glass so formed has to some extent dissolved the larger grains.

RESULTS WITH DUST No. 14.

Brick A.—The surface is well glazed, without apparent corrosion. The dust has penetrated to an average depth of 1·5 cm.; but there has been little interaction except at the surface, where everything has fused to a glass.

Brick C.—The surface has been attacked, the bond apparently reacting with the dust to form a glass, which is in process of dissolving the grog. The average depth of penetration is 0·3 cm.; but in places the molten material has worked along cracks.

MICRO-EXAMINATION.—A thin section of the surface shows that everything has been fused to a glass out of which cristobalite has been crystallizing. No quartz remains. Further from the surface the remains of larger grains can be distinguished; but these also contain no residual quartz.

General Remarks.

The furnace here indicated appears to be very well adapted to do the work for which it has been designed. Unfortunately, it has not been found possible to express the results of the corrosive action of flue-dusts in a quantitative manner by weight, by measurement, or by graphic diagram. Photographs of the effect produced by the different types of dust on different types of firebricks are not satisfactory; nor is sufficient reliance to be placed on the depth of penetration to enable it to be offered as a quantitative test.

[The Committee submitted photographic reproductions to illustrate some of the results obtained when the firebricks which have been exposed to the action of dust, are cut transversely, and the exposed section polished.]

The scheme in Table IV. is an attempt to compress the results obtained into a more compact form. It will be observed that the various types of corrosive dusts employed can be arranged in the four following groups:

(1) Producer ash, flue-dust, or coal ash, mainly ferruginous, ranging from those with a high to those with a low proportion of ferric oxide. Some iron oxides alone were also used. These dusts were selected mainly because of the peculiar behaviour of the ferruginous compounds with clays, &c. The fluxing action of ferruginous dusts is greatly facilitated when accompanied by lime.
(2) Alkali chlorides and sulphates.
(3) Lime compounds. These cross with ferruginous lime compounds.
(4) Dusts which readily form fusible silicates.

Except where specified, the atmosphere was mainly oxidizing.

This work can be regarded as having opened a big subject. It is possible that the testing of the effect of a given dust on a refractory may be best carried out by moulding mixtures of the dust and the ground refractory, in definite proportions (in the form of cores), and determining the fusing point; and this plan was followed. In general, the penetration by the dust is greater in fireclay than in silica firebricks. In most cases, the bond is attacked first and the coarser grains last.

TABLE IV.

Dust.	Firebrick.	Silica Brick.	Fine Grained Silica Brick.
Boiler dust high in lime and ferric oxide	d.P.; m.C.		
Ferruginous boiler dust	s.P.; s.C.		
Ochreous dust from retort bench	k.P.; s.C.	d.P.; g.C.	
Basic slag	d.P.; s.C.	d.P.; m.C.	
Ferruginous dust high in lime	k.P.; m.C.	d.P.; m.C.	
Bull dog		d.P.; s.C.	
Hæmatite (reducing flame)		d.P.; s.C.	s.P.; s.C.
Tap cinder	d.P.; g.C.	d.P.; m.C.	d.P.; s.C.
Lime	s.P.; m.C.	s.P.; m.C.	
Lime and salt	s.P.; m.C.	s.P.; m.C.	
Salt	d.P.; s.C.	s.P.; m.C.	
Sodium sulphate	s.P.; s.C.	s.P.; m.C.	
Salt and felspar	s.P.; s.C.	s.P.; m.C.	
Soda-lime glass	s.P.; s.C.	s.P.; m.C.	

In the table, P = penetration; C = corrosion; s = slight; d = deep; k = complete; m = medium; g C = great corrosion or slagging.

In silica bricks, the depth of penetration by the dust is generally less the finer the grain. In the fine-grained bricks, the coarser grains and the bond are both attacked; while in the coarse-grained bricks, the bond is alone attacked to any serious extent. It, therefore, follows that the bond of a silica firebrick offers the feeblest resistance to the attack of a corrosive slag.

The attack on the coarser grains of silica firebrick varies with the nature of these grains. When there is much cementing material between the quartz grains, the penetration of the rock fragments by the dust is greater than in the case of a compact rock made up of interlocking grains.

Under oxidizing conditions, iron oxide does not corrode silica bricks to any noteworthy extent; but under reducing conditions ferrous silicate forms and acts as a corrosive flux. In the trials with bull dog, the silica bricks were far less attacked than were fireclay bricks; and, generally, the iron oxides corrode fireclay bricks more than they do silica bricks.

The dusts apparently exert an influence on the conversion of the quartz into the low specific gravity form or forms, even where the coarse grains have apparently not been penetrated. This is possibly in part due to the vapours of the alkalies in the dust. There is also some evidence that contact with oxide of iron in an oxidizing flame hastens the conversion of the quartz.

When the dust is such that it can form a surface glaze, the brick is protected from further attack, or rather the subsequent rate of attack is considerably diminished. This corresponds with a well-known practice of smearing a glaze mixture on the face of the brickwork in certain kilns. If the surface glaze be fluid enough, and in such a position that it can flow to a lower level, these remarks do not apply; for the brick is rapidly eaten away as soon as the glaze begins to drip. The attempts to give the brick a resistant face by fusing the surface by means of a blowpipe flame are not satisfactory, as the surface skin peels off.

MIDLAND JUNIOR GAS ASSOCIATION.

Visits to the Works of the Bryan Donkin Company and the Staveley Coal and Iron Company.

On Saturday last, by the courtesy of the Bryan Donkin Company, Ltd., a visit was paid to the works of the Company at Chesterfield.

The party numbered nearly thirty, the majority of whom had travelled by train from Birmingham, and assembled at the works at eleven o'clock. They were met by Mr. George Clark, the Managing-Director, and Mr. Cyril Bryan Donkin, who, together with Messrs. Haslam, Buxton, Webb, Fennimore, Hamlin, Hopkinson, and Seaman, conducted the members round the various shops. An interesting souvenir booklet had been prepared specially for the occasion by the Company; and this afforded the members information concerning the history of the firm, the activities of which extend backwards over more than a century. The variety of manufactures undertaken by the Company during this long period is quite remarkable; and the visitors were shown many interesting things concerning the early work by the first Bryan Donkin—in such matters as paper making and printing machines, steel pens, the canning of meat and foodstuffs, and the Rose engine for the making of dies in two colours. The tachometer, for measuring the speed of machines, was invented by Bryan Donkin in 1810, and later he introduced a counting machine, being on that occasion referred to as "The Leading Mechanician of his Time."

The Company, established first at Bermondsey, began to devote their attention to the gas industry between 1840 and 1850; the special rack-and-pinion type of valve being introduced in 1847. Gas-exhausters were taken up about the same time. The 1847 patent was superseded in 1866 by the Beale design, which, in turn, was displaced by a later pattern in 1877.

After more than a century at Bermondsey, the works were transferred to Chesterfield, and at the present time they occupy a site of about 14 acres, and employ more than 700 hands. The works

are now driven almost entirely by electricity; the current being obtained from the Corporation at 6000 volts, three-phase, and transformed to 400 volts for use in the shops. The motors in use total over 800 B.H.P.

The members were shown practically all of the firm's well-known specialities in course of manufacture, including the various types of positive exhauster, with two, three, or four blades, valves of small and large sizes, tar and liquor pumps, governors of various types, for high and low pressure, and motor parts. The Company acquired certain rights from Prof. Rateau, of Paris, in the "turbo" exhauster; and many of these machines are at work as exhausters, boosters, blowers, &c., in gas-works, collieries, and coke-oven plants. The members were fortunate in seeing not only the single-stage type of this machine, but also a three-stage one, of largest size, both in course of construction and, in the case of a similar machine, being run on trial to be properly "balanced" before sending out.

The foundry, various workshops, ambulance room, and laboratory, provided matters of interest for much more time than the members had at disposal. In the laboratory was seen a special type of bomb calorimeter, for the determination of calorific values of fuel, which also is numbered among the firm's specialities.

LUNCHEON AND A VOTE OF THANKS.

Before leaving the works, the members were invited to lunch in the women workers' mess-room. After lunch, the toast of "The King" was given by Mr. CLARK, who officially welcomed the members.

The PRESIDENT (Mr. T. H. Poulson) proposed a hearty vote of thanks to the Bryan Donkin Company for their kind invitation to visit the works, and for their hospitality, and to Mr. Clark, Mr. Cyril Bryan Donkin, and the other gentlemen who had assisted in showing them round. They had seen some first-class engineering shops and work, and had found the visit of great interest. He wished to thank Mr. Clark specially, also, for his very good offices in arranging for the visit to the Devonshire works of the Staveley Coal and Iron Company.

Mr. R. G. MARSH (ex-President), in seconding the vote, said that, coming from the Fittings Department of the Birmingham Gas Department, he had personally very much desired to visit the works from which they received a quantity of material in the shape of valves, compressors, and governors; and he had been greatly interested to see these in process of manufacture.

Mr. W. A. TWINE (Birmingham), in supporting the vote, said that, as a visitor with the members of the Association, he had derived much pleasure from the visit, and had been impressed by the law and order in evidence everywhere, and in particular by the ambulance room, which was now recognized to be so necessary a provision in modern works.

The vote of thanks was then warmly accorded.

Mr. CLARK, in acknowledging the vote, referred to the long history of the firm and the many men of leading in industry who had been contemporary with the first Bryan Donkin. The latter knew Watt personally, and also had dealings with Brunell, Telford, Bramah, and others. The firm prided themselves on keeping up-to-date and in giving good service by good work and prompt dispatch, and they looked forward to a prosperous future. They were pleased to welcome such societies as the gas associations, because they helped to uplift the men in the gas industry to the status and position for which brains and education fitted them, and thereby assisted in making the industry strong and healthy. There was no need, in his opinion, for gas and electricity to fear one another, as a wide field of usefulness was open to both; but they must not rest on their laurels. Gas would have to hold its own, from a business standpoint; and this could only be accomplished by research, study, honest competition, and good service. He spoke also of the great value of meetings in which manufacturers and gas engineers came together, and of the work which firms such as their own were doing in research undertaken to help the engineer. He was very gratified to know that the members had found the visit interesting.

AT THE STAVELEY COAL AND IRON WORKS.

The party then proceeded by train to Staveley, where they were received by Mr. J. A. Wilson, the Coke-Oven Works Manager, who, together with Mr. Martin, the Assistant Manager of the Chemical Plant, Mr. Nicholson, the Head Chemist, and Mr. Godber, Assistant Chemist, conducted the members round the plant.

Although the weather was exceptionally fine for the time of year, the members quickly realized that to properly inspect the various units of the huge plant before darkness came, was an impossible task. The visit was therefore of necessity very hurried; but enough was seen to greatly impress the members with the extraordinary variety of the products made, their excellence, and the economy striven after in every possible direction. In particular, the battery of twelve Babcock and Wilcox boilers, fired by gas from the blast-furnaces and the waste heat from the coke-ovens, and generating steam at 150 lbs. pressure, attracted much attention. The members were informed that a further battery of sixty Simplex waste-heat ovens, of modified type, with vertical heating flues, are to be installed.

The visit was of quite exceptional interest, and the members generally felt that the full day, although strenuous, had been very well worth while.

At the Zurich municipal gas-works, says the "Schweizerische Bauzeitung," water gas is in use; and wood and peat are being employed for gas making. The poor gas is enriched with acetylene; but the cost of the process is higher than with good hard gas coal.

SCOTTISH JUNIOR GAS ASSOCIATION.

(EASTERN DISTRICT.)

Visit to Cupar.

On Saturday, about twenty members, under Mr. R. WADDELL (the President), visited the Cupar Gas-Works. The chief items of interest were the Woodall-Duckham vertical retorts, a full description of which was given on the occasion of the last visit in January, 1917. Mr. Grossert, the Chairman of the Cupar Gas Company, along with a few of the Directors and Mr. J. Macpherson, the Engineer, welcomed the members. The Manager then showed the members over the works, and explained fully the working of the vertical retorts.

After the inspection of the works, the Directors invited the members to tea in the Royal Hotel. Replying to the toast of the "Junior Gas Association," Mr. Waddell, the President, in the name of the members, thanked the Company for their hospitality. An interesting item after the tea was a presentation to Mr. J. J. Scott, the President of the Association for the past three years. On behalf of the Association, Mr. Grossert handed Mr. Scott a gold medal suitably inscribed. Mr. Scott, in thanking the members for the medal, said he was very glad he had been able to keep the flag of the Association flying during the war, and wished it every success now that peace had returned.

SCOTTISH JUNIOR GAS ASSOCIATION.

(WESTERN DISTRICT.)

Visit to the Glasgow Electricity Works.

The members paid a visit to the Dalmarnock Electricity Works of the Glasgow Corporation last Saturday week, when about eighty members were present.

These works are in course of construction, and when completed will be the largest station in Scotland. The visitors were shown round by Mr. W. W. Lackie (the Chief Engineer), along with Mr. R. Mitchell (the Assistant Chief Engineer), and Mr. W. Calderwood (the Chief Draughtsman), who explained the arrangement of the various buildings. Much interest was evinced in the method adopted for taking in the condensing water from the River Clyde, and the adoption of patent screens for keeping leaves, sticks, and other floating *débris* from entering the works. The water after use is returned to the river. A large electric transporter of 190 ft. span is to be erected over the coal-store, which is capable of accommodating 75,000 tons. Re-inforced concrete is largely used in the construction throughout the entire works. The turbine engine-house is equipped with a 75-ton electric travelling crane of 76 ft. span; and arrangements are made for four sets of turbo-alternators, each to develop 1500 kilowatts, to be placed very soon. The boiler-house is to have eight steam-boilers of the Babcock and Wilcox water-tube type, generating steam at 275 lbs. per sq. in., the steam to be superheated to a final temperature of 750° Fahr. Each boiler is to have forced and induced draught. The coal-handling plant will be capable of dealing with 100 tons per hour. The workshops are placed alongside the boiler-house, and extend also to the engine-house; and an electric travelling crane is here erected for the purpose of conveying parts of machinery from the railway siding to the turbine-house and *vice versâ*. The new station covers an area of 13 acres.

The members afterwards visited the Port Dundas works of the department, which are in full operation. These works are situated on the banks of the Forth and Clyde Canal at Spiers Wharf, and have no railway connection. The coal is brought by barges, and passed from them to the coal-store by a grab worked from a Temperley transporter. The coal storage at this station is only between 6000 and 7000 tons. The boiler-house contains seven Babcock & Wilcox marine type boilers, four Stirling boilers, and sixteen B. & W. land-type boilers, all fitted with some form of chain-grate stoker. The equipment in the turbine house consists of three 6000, one 5000, one 4000, and two 3000 kilowatt turbines and alternators, and three 800 kilowatt continuous current reciprocative sets. There are, also, two 1000 and two 500 kilowatt rotary convertors, and one 1000 kilowatt motor generator. The turbine-house is served by a 40-ton electric travelling crane. In the boiler-house, the boilers are controlled in groups by induced draught fans. Four boilers, in addition to induced draught, are operated under forced draught, so as to enable very high duties to be obtained. The system of measurements or records taken throughout the works is very complete—giving a check on all operations. Every pound of coal is weighed as it goes to the mechanical stokers. The feed water passing to the boilers is measured in Lea recorders. The percentage of CO_2 in the flue gases is also estimated; and the draught and steam output from each boiler are gauged. In the turbine-house, records are kept of steam temperatures at the turbine stop-valve, initial and final temperatures and vacuum of the condenser, and circulating water temperature for inlet and outlet; and the condensed steam is measured for each set. On the electrical side, very complete records are kept of the output from the generators; and continuous records or charts check the electric supply to the various feeding points in the city.

The company were then entertained at tea; and Mr. Lackie, Mr.

Mitchell, Mr. Calderwood, and Mr. E. Morgan (the Port Dundas Superintendent) were cordially thanked by the President (Mr. Thomas G. Moffat) for their kindness and hospitality. Mr. Mitchell (in the absence of Mr. Lackie, who had to leave) said that it had given them great pleasure to conduct the company round; and he extended, on behalf of Mr. Lackie, an invitation to them to re-visit the Dalmarnock works when completed.

STEAMING IN HORIZONTAL RETORTS.

Results at Marple.

According to an article in a recent issue of the "North Cheshire Herald," Mr. James K. Law, the Manager of the Marple District Council Gas-Works, has been experimenting with, and is as the result employing as a permanent part of his gas-making process, the steaming of the charges in his horizontal retorts, on lines the devising of which are entirely his own—while admitting that the principle is not a new one. He uses full retorts; and from the article it seems that the alterations necessary for the application to the charges of dry steam has only entailed an expenditure of some £25.

The result of his steaming experiments has been, in the first place, a saving of some 22 p.ct. of coal. For example, in the past three months the retorts have carbonized 123 tons of coal less than would have been the case before for the same amount of gas; and on this basis, he calculates a saving of £890 on coal for the year. The extra cost of working he finds is infinitesimal; but there is the salient fact that he is now securing an average return per ton of coal of 14,470 c.ft. The article, however, does not appear to give information as to the quality of the gas; nor does it state in definite figures the results achieved before steaming was applied. But, of course, a rough estimate can be made from what has been said as to the saving of 22 p.ct. of coal. Mr. Law finds several collateral advantages. For instance, in respect to the scurfing of the retorts and the necessity for pipe-cleaning, which has been altogether removed. The quality and quantity of the coke is said to be as satisfactory as before; and the tar, liquor, and other residuals are also unaffected, while a good test of the value of the gas is that power users are entirely satisfied—in fact, there has not been from them a single complaint during the three months' use.

It was expected that at the end of the current financial year there would be a deficit of £1000; but it is hoped that now, while the price of gas will remain as at present, there will be a small credit balance, instead of this deficit. Both the consumers and the ratepayers will therefore have every reason to congratulate Mr. Law upon his enterprise and success.

Masonic.

A Convocation of the Evening Star Chapter, No. 1719, was held at the Freemasons' Hall, London, on Wednesday last, when the Principals and Officers for 1919 were elected, as follows:

William Dommett	M.E.Z.
George Hands	H.
William Belton	J.
Rae P. Normand	Scribe E.
W. A. Surridge	Treasurer.
F. A. West	D.C.
Arthur Valon	Scribe N.
William Edgar	Organist.
W. R. Silk	P.Soj.
Walter T. Dunn	First A.Soj.
F. C. Tilley	Second A.Soj.
H. W. Packham	Steward.
S. Freeman Burrows	Steward.
C. W. Braine	Steward.

Synthetic Ammonia.—Reference is made by "Chemical and Metallurgical Engineering" to a United States patent for the production of synthetic ammonia, by passing a mixture of nitrogen and hydrogen at high pressure and temperature—*i.e.*, 40 atmospheres and 500° C.—in the proportion of 1 to 3 by volume over catalytic materials of the type of nickel-cobalt carbide. When this is done, a chemical reaction takes place, which produces synthetic ammonia.

Institution of Gas Engineers and Victory.—It was intimated by the President (Mr. Samuel Glover) at last month's meeting of the Institution of Gas Engineers that, in addition to one to the King, telegrams would be dispatched to the Commanders in the Field, expressing gratitude for the magnificent victories achieved, and assuring them that the supply of raw materials for the production of high explosives essential to complete victory would be maintained. In reply, Marshal Foch said he appreciated highly the assurance given of the active and complete collaboration of all supporters. Sir Douglas Haig sent his best thanks for the congratulations and promise, which all ranks greatly appreciated. The King of the Belgians (through his Secretary) and General Diaz also forwarded cordial acknowledgments, as did General Pershing, who added: "The support of the men manufacturing munitions for the Allies has been splendid."

DEVELOPMENT OF THE INDUSTRIAL GAS FIELD.

Some particulars with regard to the development of the industrial gas field were given, in a paper presented at the eleventh annual meeting of the Canadian Gas Association, by Mr. Charles D. Slimpin, the Industrial Engineer of the Montreal Light, Heat, and Power Company, who said during the past four years the industrial gas field has been developed to a greater extent, and larger gas installations have been made, than in all the years previously. Hardly a day passes without information of some large new gas installation being made which a few years ago would have been looked upon as being impracticable.

The author's Company were fortunate enough to be given a trial in the first shell manufacturing plant in the neighbourhood; and up to the present time, they have sold gas for this line of work amounting to about $500,000, the sales at present being at the rate of 360,000,000 c.ft. a year. They have had their best results in the plants where shrapnel shells, bullets, time-fuses, cartridge cases, &c., and high explosive shells up to 6-in. are made; and there are several plants that are all-gas. In the case of one of these latter, the consumption is about 10,000,000 c.ft. per month; the output being 6000 to 7000 shells per day. Gas is, as a matter of fact, being successfully used for the nosing of shrapnel and high explosive shells up to 6-in.; for all work in connection with fuses and caps, from the melting of the metal to the assembling of parts; for the manufacture of paints and varnishes, and for their drying and baking after being placed on shells; for the melting of bullet metal for shrapnel; and for soldering powder cups, cans, &c., annealing cartridge-cases, all tool work, shrinking copper bands on shells, melting rosin for shrapnel, annealing and tempering various sized shells, tube annealing, sand-blast dryers, &c. In practically all these places, the gas appliances are home-made or rebuilt, as at the time the business began to come along it was impossible to secure what was required. Some of the appliances were made and in operation within a few days after giving the order; the Company seeing to it that the burners, &c., were so made and installed as to give the best results possible.

Over thirty illustrations of installations (many referring to large cooking outfits) accompanied the paper—affording convincing evidence of the energy displayed in developing the industrial field for gas in Montreal. Almost any sized company, Mr. Slimpin says, can afford to have someone to work the industrial gas field; and the man selected for the job must have a fair amount of common-sense, good judgment, all the education possible, be able to meet any type of person without feeling at all embarrassed, put up a good straightforward line of talk or argument, and know his own particular business as well as something of that of his customer, so as to be able to tell him just how and where gas can be used to advantage. Having said this, however, he issues the following warning on the subject to gas companies: It must be borne in mind that a man who can make a success as an industrial gas man has picked up considerable knowledge of many other lines of business; and unless you are paying him a fair salary, he himself is very apt to be picked up possibly by companies with whom he has been doing gas business. The gas industry have in the past five years lost more good industrial gas men than would be required to fill all vacancies to-day, because of non-appreciation or misunderstanding of the results accomplished by their men. If gas companies spent as much time, money, and energy on industrial gas as some of them have on gas-irons, they would all be better off to-day.

Good Lighting Conducing to the Reduction of Accidents.

Records recently issued by the Travellers' Insurance Company of the United States show that of 91,000 industrial accidents recorded in 1910, 23·8 p.ct. were due directly or indirectly to poor lighting. Of course, this record refers only to the accidents investigated by this one Insurance Company. For the same period an estimate is made that puts the total industrial accidents of the United States at 500,000; and, upon the basis of the Travellers' Insurance Company's percentages, about 125,000 of these accidents were chargeable to the lack of proper illumination eight years ago. Since that time Insurance Companies have studied lighting conditions in factories in order to classify the risk; and, as proper lighting resulted in lower premiums, it was not long before factory managers and their engineers worked out better methods of illumination. The result of this is that during the last two or three years the improvements in lighting have caused a reduction of at least 30 p.ct. in accidents chargeable to the lack of proper illumination.

Temporary Increase of Charges Act.—The Board of Trade have made Orders under the Statutory Undertakings (Temporary Increase of Charges) Act in favour of the Builth Gas and Coke Company, Ltd., the Houghton-le-Spring District Gas Company, and the Horsham Gas Company. The Board have also received applications for Orders from the Bishop's Stortford, Harlow, and Epping Gas and Electricity Company, the Brading Harbour District Gas Company, the Stroud Water Company, the South Staffordshire Water-Works Company, the Penistone and District Gas Company, and the Portsea Island Gas Light Company.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Institution, Organization, and Housing for the Industry.

SIR,—It is a great satisfaction to me to see the letter of Mr. Charles Carpenter, D.Sc.; for I take this as an assurance that the movement has found a leader, under whom its success is practically assured. May I suggest to the Council of the Institution the desirability of at once appointing a Committee of their members, with or without co-opted members, to consider the subject and report at an early date? As Mr. Carpenter has expressed it, there would be a fitness in the Institution taking the initiative in so important a matter, though in some quarters a desire has been expressed for the formation of a separate Committee.

Periodically the question arises as to provision of better housing accommodation for the industry. Why should not this be tackled at the same time? I never quite understood why Mr. Broadberry was so easily turned from the building scheme which he launched last year with what appeared to be the fairest prospects of success. At the meeting convened by him, which I had the pleasure of attending, several offers of substantial sums were at once forthcoming; and these could no doubt be quickly added to. Why should we continue to be under the reproach of not having strength to bring forth that which has been so well conceived? Ought not our motto to be henceforth the old Cornish one of "One and All"?

CHAS. HUNT.

17, *Victoria Street, S.W., Nov.* 16, 1918.

SIR,—I am glad to learn, after reading the letters of Mr. Charles Carpenter, D.Sc., and Mr. Charles Hunt, that two experienced and influential members of the profession have given their advice on the important question of a united Association for the gas industry; and I fully agree with them.

Mr. Carpenter, by virtue of his position in connection with the British Chemical Industries, has had some recent experience of how the Articles of an important Association, or industry, should be framed to be representative of Great Britain when applying for a Royal Charter. I have seen these Articles, and find that they embrace all branches of the industry, and especially the manufacturing and commercial sections of chemistry allied to gas industries; and I think that those representing these industries would do well to follow this model of recent date.

Great progress will be expected from the profession in the future. Therefore it is most essential that we have a very strong representation, embracing all the existing Technical and Commercial Organizations of the gas profession in which individual interests are identical in every respect. A British Gas Association would not completely represent the interests of the profession if any important section is excluded. On this point, I am informed that the Government will not grant a Charter if any of the important Associations are eliminated.

The time for invidious selection has surely long ago passed away; and as we have a community of interest, and unity is strength, why not go forward as one complete body fully representative of the whole of the gas industry? I am fully convinced that if all the members have an opportunity of a straight vote on this question, their united judgment will prescribe that only one great and combined British Gas Association should be formed to represent the whole of our important interests.

JOHN WEST.

Alton Lodge, Park Crescent, Southport, Nov. 15, 1918.

Boiling-Burner Efficiencies.

SIR,—We have read with much interest the Research Committee's report on boiling-burner efficiencies, as well as the correspondence upon the subject which has appeared in the "JOURNAL." But, in our opinion, one of the most vital considerations of the matter has been entirely ignored (unless purposely avoided) both in the report itself, and in the ensuing correspondence.

As gas-stove makers continuously occupied with both the scientific and the practical investigation of boiling-burner efficiencies—using mixed gases at different pressures, and working under the varying conditions encountered by users of gas-cookers—we have been greatly astonished at the lowness of the efficiencies revealed by a very exhaustive series of tests embracing almost every well-known make of cooker hotplate.

We do not allege, and it is not even to be supposed, that gas-stove makers as a body have been unaware of this lack of efficiency in boiling-burners; nor do we suggest that they have been without the capacity and means to effect the much-needed improvement. The handicap, in our opinion, has been the absence of anything in the nature of uniform practice in gas manufacture, and the consequent necessity of providing burners which, while capable of giving reasonably good results under the most unfavourable conditions likely to be encountered, should yet be capable of more or less satisfactory service (apart from the question of efficiency) under any of the wide variations met with in different supply areas of the British gas undertakings.

It must, however, be confessed that, making every allowance for the restricting effect of this requirement, gas-stove makers have not shown themselves to be as progressive as they might have been, and as they would necessarily have been, had the stimulus of competition been greater than has, in fact, been the case.

We have for long entertained the opinion that any well-directed attempt to improve boiling-burner efficiencies must recognize the primary need for providing burners so constructed as to be capable of maintaining their test-room efficiency in actual domestic use—and this irrespective of the quality or pressure of the gas, and of any peculiar conditions under which it is supplied and consumed.

The principle just stated is one which we have ourselves applied; and immediately labour and other conditions permit, we shall be ready to supply to gas undertakings stoves yielding even higher efficiencies, under average circumstances, than those obtained under the highly favourable laboratory conditions of the Research Committee's report. Such apparatus will also (and this, in our view, is the vital consideration) be capable of maintaining their high efficiency under extremely wide variations in gas quality, gas pressure, and conditions of supply. We believe, indeed, that our new cookers will represent the biggest single step forward that has yet been recorded in the scientific development of such gas plant.

DAVIS GAS-STOVE CO., LTD.,
per CYRIL G. DAVIS, Managing Director.

60, *Oxford Street, W., Nov.* 18, 1918.

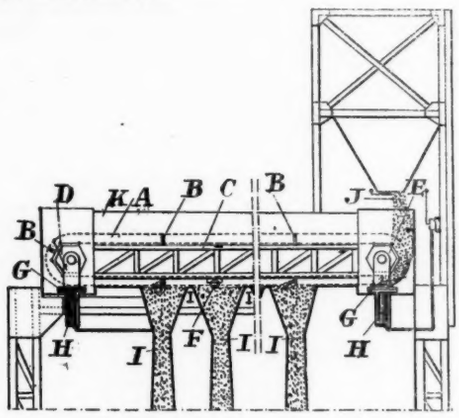
REGISTER OF PATENTS.

Charging Vertical Retorts or Ovens.—No. 113, 4 5.

PIETERS, J., of Paris.

No. 1272; Jan. 22, 1918. Convention date, Feb. 10, 1917.

This invention relates to apparatus for distributing coal uniformly over the whole extent of the retorts or oven, arranged in a battery, and producing a certain pressure at any desired moment, or at regular intervals of time, according to the regulation adopted. This uniform distribution of coal, and the subsequent pressure, is intended to prevent any empty spaces being formed, and (by bringing all the particles very close together) to produce a very compact material through which, owing to its comparatively great height, no gases can pass either in one or in the other direction, even at higher pressures than those that normally exist in coke-ovens.



Pieters' Vertical Retort and Oven Charger.

An endless chain A, to which are secured scrapers B, arranged at regular intervals, is supported by a girder C extending throughout the whole length of the battery of ovens to be served. The girder rests at its ends on the spindles of drums D E used to drive the chain, movement to which is imparted by controlling mechanism. At regular intervals there are also secured to the chain (so as to participate in its movement) rollers F. The bearings supporting the spindles of the drums are carried by plates or discs G, which can be raised by hydraulic pressure pistons H; and normally the whole weight of the movable part is supported by them. If the pressure on them is reduced, a portion (or even the whole) of the weight will rest on the rollers F. The latter, in passing above the various ovens, therefore exercise on the coal piled up in the passages I a considerable pressure, owing to the total weight of the movable part. A handle operated by the attendant regulates the admission and discharge of water under pressure coming from an accumulator to the pistons, and so graduates the pressure exercised on the material. The admission of material to be distilled is at J; and in order to ensure great elasticity in its admission, the chain with scrapers, as well as the whole of the girder C, is raised in the interior of a reservoir K to such a height as to allow coal to accumulate—the reservoir regulating the supply of coal to the various retorts.

Water Heaters or Geysers.—No. 119,417.

DAVIS GAS-STOVE COMPANY, LTD., and BARRALET, J. H., of Luton.

No. 7469; May 3, 1918.

This invention relates to geysers of the open type wherein the inlet water is directed on to a convex deflecting plate provided with projecting tongues and adjacent holes; the underside of the plate being formed with depending points from which the divided water is precipitated on to a convex plate disposed over the burner and then into a coned annular chamber provided with an outlet.

In geysers where the water to be heated passes into a central vertical tube and terminates in a perforated distributing head, and after escaping therefrom falls on heated conical plates, it has previously been proposed to provide a conical trough above the burner, formed with holes through which the water passes on to a conical deflector and thence into a coned annular member. But according to the present invention the convex shaped baffle or water deflector disposed above the burner is formed with a flange having holes or serrations

and lower projecting points. The baffle is so arranged that the water precipitated from the upper deflecting plate will be contained in the lower baffle or trough, rise to the level of the holes in the side of it, and be again precipitated from the lower projecting points on to the cone-shaped burner baffle or deflector.

Gas-Fired Tool-Heating Furnaces.—No. 119,817.

YATES, H. JAMES, of Aston, Birmingham, and BRAYSHAW, S. N. & E. R., of Hulme, Manchester.

No. 4797; March 19, 1918.

This invention relates to gas-fired furnaces for such purposes as the heating of high-speed steel and the heating of cutters and other tools for tempering or hardening. In previous patents (No. 22,522 of 1907 and No. 23,066 of 1911) the present applicants described methods of operating the doors of furnaces, and in the patent No. 110,960 they described a particular construction of burner for furnaces. They describe in their present specification a furnace embodying a combined construction of the earlier improvements in a single furnace.

Retorts for Distilling or Carbonizing Carbonaceous Materials.—No. 119,911.

BRADLEY, A., of Westbourne Terrace, Hyde Park, W.

No. 15,134; Oct. 18, 1917.

The patentee points out that an obvious objection to an endless chain or band conveyor in a continuously operating horizontal retort is that it is practically essential that the idle length of the conveyor should travel outside—involving waste of heat; while the substitution of a worm conveyor avoids the waste, but introduces other troubles—such as jamming of the charge and increased production of dust. By causing the charge to travel successively through superimposed chambers set in the same furnace, there is no idle length of chain conveyor; but the output from such plants is small compared with that from a single retort chamber of the same capacity, and dust production is greater. Moreover, for low temperature carbonization, control of temperature in the retort chamber is of paramount importance, but is very difficult to attain when the charge passes through several retorts set in the same furnace.

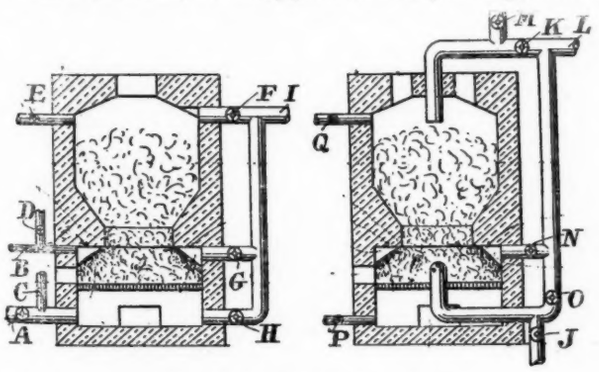
The present invention relates to a continuously operating plant for low-temperature carbonization (or for roasting ores) in which an endless chain or band conveyor travels in two adjacent, separately heated, horizontal or slightly inclined retorts, each provided with a charging device for the introduction of fresh material.

Burning Solid Fuel in Gas-Producers. No. 120,011.

THUMAN, F., of Victoria Street, Westminster; a communication from O. B. EVANS, of Lansdowne, Delaware, U.S.A.

No. 10,206; June 20, 1918.

This invention is applicable not only to the furnaces of gas-producers in which combustion is incomplete and from which gas generated is led away, but also to other furnaces in which combustion is complete—the principal object of it is to prevent the adherence of clinker to the side wall of the furnace, and thereby permit of the easy cleaning of the fire.



Evans's Water-Gas Producer Furnace.

The illustrations show two views of a type of furnace used in connection with a water-gas apparatus.

A B are air-connections; and C, D, E are connections for admitting steam, products of combustion, or the like. F, G, H are valved off-take connections for fuel gas, products of combustion, and the like, which are led from the generator through the connection I. The blow consists in admitting air through connections A B, and discharging the products through the open valve F into connection I. During this period of blow, steam, products of combustion, or the like, may be admitted through valves C D, according to the character of fuel used. During the gas making, or run, period, the air valves A B are closed; and steam is admitted through valves C D, or both, and passes up through the fire—the resultant gas escaping through the open valve F into the off-take I. When it is desired to reverse the gas-making direction, valves C D F are closed, steam is admitted through E, and the resultant gas escapes either through the valve G or H into connection I, as desired. By means of the auxiliary valve G it is possible to further control the location of the temperature zones of the generator.

In the second arrangement, the process is as described, and the blow consists in admitting air (which may be mixed with products of combustion), steam, or the like, through the valve J, to the base of the fire; the products escaping through the valve K and connection L, or by admitting air mixed with products of combustion, steam, or the like, through the valve M, and allowing the products of combustion to pass out through valves N or O to connection L. During the run, steam is admitted through P, the resultant gas leaving through the valve K and connection L, or steam is admitted through the valve Q—the products leaving through the valves N or O. By changing the direction of application of the gas-making fluids, and by taking off the products at various points in the fuel bed, the location of the temperature zones can be changed as desired.

In practice, a burning fuel bed is fed through the furnace chamber in which there is created and maintained, near the furnace wall, a temperature zone where fused clinker solidifies. The surfaces of the furnace wall and of the fuel bed are separated at this zone, so that the clinker of the fuel bed passing through it solidifies-out of contact with the furnace wall. This may be accomplished by properly proportioning the cross-sectional areas of the furnace and of the fuel bed for separating the surfaces of the fuel bed and of the furnace wall at the temperature zone of the solidification of clinker in the passing fuel.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Nov. 13.]

Nos. 17,973—18,398.

AITCHES, LTD.—"Incandescent mantles." No. 18,248.
BARBET ET FILS ET CIE., E.—"Removing tar from products of distillation of wood, coal, &c." No. 18,026.
CARMONT, W. E.—"Construction of gas-stoves." No. 18,263.
DELLWIK, C.—"Combustion of fuel." No. 18,392.
FABINI, H. V.—See Aitches. No. 18,248.
GODALL, C.—"Valves or taps." No. 18,087.
GOLIGHTLY, G. H. & H. H.—"Pipe connections." No. 18,171.
GRIGGS, A. R.—"Hydrogen generators." Nos. 18,382, 18,383, 18,384.
HAYES, P. T.—"Device for increasing illuminating power of gas." No. 18,223.
LEWIS, G. M.—"Gas-stoves, fires, &c." No. 18,302.
MAGRATH, H. J.—"Apparatus for measuring-out charges of gases." No. 18,114.
MARSH, R. G.—See Lewis. No. 18,302.
MENZIES, S. H.—See Magrath. No. 18,114.
PIGGOTT & Co., T.—"Pipe joints." No. 18,172.
ROCKALL, W. J.—"Gas-saving appliance for cooking." No. 18,203.
ROGERS, R. J.—See Lewis. No. 18,302.
SCHOFIELD, L.—"Water-heaters." No. 18,264.
SHEARD, J. T.—"Producing neutral sulphate of ammonia." No. 18,362.
STOTT, V. H.—See Schofield. No. 18,264.
TECHNO-CHEMICAL LABORATORIES, LTD.—See Dellwik. No. 18,392.
VILLAMIT, R. DE.—"Silencer for gas-engines." No. 18,007.
WARBURTON, A. J. G.—See Hayes. No. 18,223.
WAYNE, A. C.—"Gas pan or kettle." No. 18,091.
WHITTAKER, C.—See Godall. No. 18,087.
WIGGIN, J. W.—"Taps or cocks." No. 18,393.
WOODWARD, J. T.—See Piggott. No. 18,172.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Progress of Bills.

The Gas Light and Coke Company's Bill was reported, without amendment, read a third time, and passed.

The Commercial Gas Bill was read a third time, with the amendments, passed, and returned to the Commons.

The Llandrindod Wells Urban District Council have deposited a petition against the Gas and Water Provisional Orders Confirmation Bill (Llandrindod Wells Gas Order). The opposition to the Order was subsequently withdrawn.

The South Suburban Gas Bill was read a third time, with amendments, passed, and returned to the Commons.

The Gas Provisional Orders Bill and the Gas and Water Provisional Orders Bill were read a second time, reported with amendments, recommitted to a Committee of the Whole House, read a third time, and returned to the Commons.

The Brentford Gas Bill and the South Shields Gas Bill were brought from the Commons, read the first time, and referred to the Examiners.

HOUSE OF COMMONS.

Progress of Bills.

The Lords amendments to the South Metropolitan Gas Bill were considered and agreed to.

The Brentford Gas Bill and the South Shields Gas Bill were reported, with amendments, read the third time, and passed.

Coal Conservation and Electric Power Depôts.

Sir J. D. REES asked the President of the Board of Trade whether he was aware of the opinion held by borough councils and others to the effect that the recommendations of the reports of the Coal Conservation Sub-Committee to the Ministry of Reconstruction and the Electric Power Committee to the Board of Trade should be translated into effective legislation by Parliament at the earliest possible moment; and, seeing that it was of the utmost importance that the Government

should provide industry with the means indicated in these reports of absorbing the labour which would be available on demobilization with the least possible dislocation and delay, would he take steps to carry out these recommendations.

Sir A. STANLEY replied that he was aware of the opinions held, and fully realized the importance of the matter. He hoped to be able to place before Parliament proposals for legislation with the least possible delay.

Lighting Restrictions.

Mr. BRACE, in reply to a number of questions dealing with the lighting restrictions, addressed to the Home Secretary, the President of the Board of Trade, and the President of the Local Government Board, said that instructions had been given that the shading of street lamps and of the windows of shops and houses might be removed, and additional street lamps might be lighted where those in use were less than half the normal number; but in view of the shortage of coal, not more than half should be brought into use, and the prohibition of lights in shop windows and of advertisement lights must for the present be maintained. The Commissioner of Police had given instructions that trams and omnibuses might resume normal lighting, except that, in the interests of safety, the canopy lights and headlights on trams should not at present be increased. As to the lighting of public vehicles, instructions had already been issued by the Commissioner of Police.

Mr. G. TERRELL asked the Under-Secretary of State for the Home Department whether he could see his way, in view of the termination of hostilities, to forthwith withdraw all restrictions as to lights, and particularly motor headlights.

Mr. BRACE replied that with regard to street lights, and lights in houses and shops, he would refer to the answer he had already given to questions on the same subject. The relaxations which he had announced applied not only to the Metropolitan police district, but generally throughout the country, except that the naval authorities desired that the restrictions on lights visible from the sea should not be withdrawn at present on certain parts of the coast. The question of lights on vehicles was under consideration, and for the present the restrictions remained in force.

Lighting Restrictions in Ireland.

Mr. BOYLE asked the Chief Secretary for Ireland if he was aware that the New Lighting Restrictions Order in Ireland was strongly objected to by traders in country towns, not on the ground of the number of hours allowed for lighting, but on the arrangement of these hours; whether he was aware that in Ballina (co. Mayo), under the old arrangements, less light was consumed than under the new Order, though the new arrangement would totally dislocate its business; and whether he would suggest to the responsible authority that, while the number of hours allowed for lighting should be fixed, the daily distribution of these hours should be fixed in each town so as to suit local convenience.

Mr. SHORTT replied that representations in the sense indicated in the question had been received, and were under consideration. An Amending Order was in course of preparation and would be published shortly.

Fuel and Lighting and the General Election.

Sir JOHN RANDLES asked the President of the Local Government Board whether he would communicate with the Fuel Controller as to the release of a certain amount of fuel and lighting for the use of candidates in their respective Committee Rooms at the forthcoming General Election.

Sir A. STANLEY, who replied, said that the local fuel overseers would be instructed to make such reasonable allowances of coal as may be necessary to prevent hardships to candidates and those engaged in the work involved by the election.

SOUTH SHIELDS GAS BILL.

All the petitions against the Bill promoted by the South Shields Gas Company having been withdrawn, it came last Tuesday, as an unopposed measure, before a House of Commons Committee presided over by Mr. Whitley.

Mr. BROWN (Messrs. Dyson & Co., Parliamentary Agents for the promoters), in an explanatory statement, said it was proposed to extend the Company's area of supply by the inclusion of a portion of the parish of Whitburn, which was situated between the district of the South Shields Company and that of the Sunderland Gas Company. An arrangement had been made that, should the Sunderland Company, by a Bill promoted in the session of 1919, apply for the addition to their area of the part of Whitburn referred to, the South Shields Company would not oppose the request; and should the Sunderland Company's application be granted, and that Company be supplying gas within the district within three years after having obtained statutory powers or after the termination of the war (whichever might be the later), the promoters' powers under clause 5 of this Bill would cease to be operative. Clauses which would empower the South Shields Company to use certain lands for the carrying-on of tar distillation and the conversion and storage of materials used in the manufacture of tar, and products resulting from its distillation, had met with rather strenuous opposition; and the promoters had agreed to reduce the powers to those set forth in the Model Clauses. By clauses 12 to 15, a standard of calorific power would be substituted for the illuminating power standard; and to meet the wishes of the local authorities, the provisions relating to the testing of gas by the new standard had been set out fully. In the next five clauses, authority was taken to supply power gas by agreement to any person within the Company's limits of supply. The clauses were in the usual form, except in one respect—and this departure was not without precedent—namely, that the power gas might be used for lighting by means of incandescent burners, but not otherwise, any premises to which power gas was supplied for any industrial or manufacturing purpose, excluding any part of the premises used as a dwelling-house, office, shop for the sale of goods, or other like building. Power gas might be used also for street lighting. The clauses contained a provision that the regulations to be made by the Home Secretary in regard to the use of power gas might extend to securing health as well as safety. As to the financial clauses, great importance was attached by the promoters to the power which they sought to borrow on mortgage, immediately after the passing of the Bill, the difference between the amount which they had already raised by borrowing and one-half of the existing capital of the Company. This would enable them to raise at once about £55,000. The Company had to-day no debenture stock. It would be in the interests alike of their ordinary shareholders and of the consumers that the money should be borrowed—this being the cheapest way in which it could be obtained at the present time. There was no question of impairing existing interests by this procedure in the present case. The Company had reason to anticipate a large increase in the number of consumers in their area, owing in part to the erection of dwellings under town-planning schemes which four local authorities had resolved to undertake, and in part to the more extended use in future of gas for a variety of industrial purposes. The present unexercised powers, both capital and loan, of the Company amounted to about £178,000; and allowing for £42,000 overspent on capital account and an addition of £77,000 provided for in the Bill, the additional capital powers would be £214,000, which was some £32,000 less than the estimated capital expenditure during the next twelve years. The rate of dividend upon any preference stock issued after the passing of the Bill would be 7 p.ct., instead of 5 p.ct. as provided in the Company's Act of 1904.

The CHAIRMAN said the fact that there were no debentures removed the objection which otherwise the Committee would have taken to 50 p.ct. of the money being borrowed.

Mr. *T. H. Duxbury*, the Manager of the Company, in giving evidence, said that separate mains would be laid for the supply of power gas. The intention was not to permeate the district with such mains, but to run them alongside the river. He could not submit statistics as to the prospective consumption of power gas; but the Tyneside was pre-eminently a suitable district in which a supply should be available for use in the shipyards and other works. Raw fuel was being used in the bulk of the furnaces there at present. As to the domestic supply of gas, he pointed out that there were already 8000 tenements in the Company's area not supplied with gas; and a further 2000 houses were to be built under the Housing and Town Planning Schemes of local authorities. He calculated that at least half the number would need gas supplies.

The Bill, amended in the manner indicated by Mr. Brown, was ordered to be reported to the House.

Presentation of Royal Humane Society Medals in Birmingham.

At the conclusion of a meeting of the Birmingham Gas Committee on Monday of last week, five men, Thomas Cotterill, John Downes, Joseph Floyd, Samuel Buxton, and Walter Lowe, were presented with bronze medals and certificates awarded by the Royal Humane Society, for rescuing fellow workmen who had been gassed at the Adderley Street works of the Corporation. The Lord Mayor (Alderman Sir David Brooks) called upon Mr. J. C. Vaudrey (the Hon. Local Representative of the Society) to briefly state the circumstances of the rescue. Mr. Vaudrey said the medals were awarded for saving, or attempting to save, life at the Adderley Street Gas-Works on July 15 last, when a purifier foreman, named Arthur Hodnett, descended a gasholder well about 35 ft. deep for the purpose of carrying out certain work. Gas escaped into the well, and Hodnett tried to reach the surface by climbing the ladder provided. When he had climbed about eight rungs, he was overcome by the gas, and fell to the bottom of the well. William Cotterill at once went down the well to the rescue, but found he could not get Hodnett up, and asked for help. Then John Downes descended; and a rope was dropped from the top. By this time, Cotterill was overcome with gas; but Downes succeeded in passing a rope round him, and was then also overcome. Samuel Buxton (coke foreman) then put on a smoke-helmet, and went down; and with the assistance of Joseph Floyd and Walter Lowe, the three men were brought up. Cotterill and Downes were removed to hospital, and recovered; but Hodnett unfortunately died. The medals are awarded to these men by the Royal Humane Society in recognition of the gallantry and self-sacrifice shown in their plucky attempt to save their comrades. The Society, in addition to making awards for rescues from drowning, some time ago decided to recognize attempts involving the risk of life to rescuers in other spheres, including gas-works. The Lord Mayor said it was with feelings of great satisfaction and pride that he was there to present the medals. When Britons were wanted to offer their lives to save a fellow creature, they went without hesitation. This spirit animated the men who had been awarded the medals. Sir Hallewell Rogers remarked that he had already had the pleasure of presenting a gold watch to each man; and he was sure they very much appreciated the Lord Mayor's remarks. He also expressed the thanks of all concerned to Mr. Vaudrey, who, in acknowledging the compliment, stated that two further medals had been awarded to Birmingham gas workers for rescuing a fellow workman at the Nechells works.

English Oilfields, Ltd.—At the statutory meeting of the Company (presided over by Sir James Heath, Bart., J.P.) a statement on the property was made by Dr. W. F. Leslie, F.G.S. (the Managing-Director), who said the field was of such a large extent, the oil-impregnated zones were so thick throughout, and the mining and transport conditions so ideal, that the great difficulty before the examining experts had been to minimize the value, rather than to err on the side of exaggeration. Adjacent to the first works, it was proposed to erect a plant on a large plan. There was immediately available for treatment something like 5,000,000 tons of shale, yielding in suitable retorts an average of 30 gallons of crude oil per ton of shale, and within easy stripping depth below the surface. Therefore, the cost of stripping and delivering to the retorts would be very small.

MISCELLANEOUS NEWS.

LONDON COUNTY COUNCIL AND GAS BILLS.

Report on the Action Taken.

In their report which was included in the agenda for last Tuesday's meeting of the London County Council, the Parliamentary Committee made the following reference to Gas Bills of the session 1918, in which the Council were interested.

The first four Bills contained provisions for temporary alterations in the present law regulating the relations between the price charged for gas and the amount of dividend which may be distributed. This question was dealt with in the Statutory Undertakings (Temporary Increase of Charges) Bill, which has since become law; and the provisions relating thereto in the Bills were accordingly withdrawn. Below is a summary of the provisions of the Bills, in addition to that relating to the sliding-scale, and of the action taken by the Committee.

GAS LIGHT AND COKE COMPANY BILL.

The purpose of the Bill was to confer further powers upon the Company as to the method of exercising their existing capital powers. We gave instructions for a petition against the Bill to be deposited. The point at issue was the proposal contained in clause 5, under which the Company sought power to set aside, out of revenue, sums for the redemption of the redeemable debenture stock authorized to be issued by the Bill, and to apply other moneys they might have in their hands for that purpose. Such a course would have involved an unjustifiable charge on the consumers. The promoters submitted satisfactory amendments to meet this objection; and the Council's petition was therefore withdrawn.

COMMERCIAL GAS BILL.

The Bill was for the purpose of enabling the Company to raise additional capital and to raise new denominations of preference and debenture stock. A petition against the Bill was deposited. Clause 5 (4) provided for the formation of a sinking fund out of revenue for the purpose of redeeming stock to be issued under the Bill, and clause 9 enabled the Company to make first issues of preference and debenture stock to consumers and employees at prices to yield to the investor 7 p.ct. and 6½ p.ct. respectively. The promoters agreed to strike out of the Bill the first-mentioned clause, and to amend the other clause so as to provide that the price at which the stock should be first offered should be such as is approved by the Chairman of the Committee of the London Stock Exchange. These amendments appeared to be satisfactory; and the Council's petition was therefore withdrawn.

SOUTH METROPOLITAN GAS BILL.

This Bill was to enable the Company to raise additional capital. It was proposed, under clause 3, to raise additional capital not exceeding in the whole (including any premium obtained) £750,000, by the creation and issue of South Metropolitan Gas Company's stock and of preference stock, or partly by one means and partly by the other, and also, by clause 4, to borrow on mortgage sums not exceeding in the whole one-third of the amount of the additional capital borrowed under clause 3. We had no information before us as to the necessity for this large amount of additional capital; and we accordingly gave instructions for a petition against the Bill to be deposited. But upon receiving from the promoters an explanation as to the needs of the Company, and an undertaking to reduce the total amount, including loan capital, to be raised under the Bill by £150,000, we did not consider it necessary to proceed with the opposition. The petition was therefore withdrawn.

SOUTH SUBURBAN GAS BILL.

This Bill was to authorize the acquisition by the South Suburban Gas Company of the undertaking of the Dartford Gas Company, and also to enable the Company to enter into agreements for the sale of electrical energy generated by the Company. We gave instructions for a petition to be deposited against the Bill, and for a letter to be sent to the Board of Trade objecting to the electrical energy proposal. Clauses 34 and 35, relating to the sale of electrical energy, and clause 43, enabling the reserve fund to be used to maintain standard rates of dividend, were withdrawn; and an amendment was made in clause 49 making the terms of any first issue to consumers and employees of debenture and preference stocks of a new denomination subject to the approval of the Chairman of the Committee of the Stock Exchange. Upon these amendments being made, the Council's petition was withdrawn; but a further question having arisen on clauses 36 and 37, relating to the supply of power gas, the Council's right to take action in the House of Lords was reserved.

WANDSWORTH, WIMBLEDON, AND EPSOM DISTRICT GAS BILL.

This Bill was to confer powers upon the Wandsworth, Wimbledon, and Epsom District Gas Company to take lands compulsorily, to raise additional capital, and for other purposes. A petition to protect the Council's interests was deposited; but an agreement in accordance with the resolution of the Council with regard to the stopping-up of Church Walk having been entered into, the petition was withdrawn. The Bill has received the Royal Assent.

BRENTFORD GAS BILL.

This Bill was for the purpose of enabling the Brentford Gas Company to purchase a large amount of additional land in Chiswick, to alter temporarily the provisions of the Company's Act of 1914 as to limitations of profits, and to raise further capital. A petition against the Bill was deposited. The Bill was on Sept. 30 awaiting consideration by Committee in the House of Commons; and we will report later as to any subsequent action which may be taken.

HAMPTON COURT GAS BILL.

The Council gave instructions for a petition to be presented, if necessary, against the Hampton Court Gas Bill. The purpose of the Bill

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was to authorize the Hampton Court Gas Company to enter into agreements for the generation and supply of electrical energy to any electrical undertaking in or adjacent to the Company's area of supply. We expressed to the Board of Trade the opinion that a proposal of this nature should not be allowed to proceed at a time when the whole question of the supply of electricity was under consideration by a Departmental Committee of the Board. The Bill was withdrawn by the promoters.

RAILWAY-WAGONS DISPOSAL ORDER.

England and Wales.

An Order, dated Nov. 9, has been made by the Board of Trade under the Defence of the Realm Regulations:

1.—The trader responsible for the unloading of any railway-wagon containing coal, coke, or patent fuel delivered by a railway company shall unload it or take delivery of the contents thereof, and shall tender it to or place it at the disposal of the railway company within such time as is specified in the first part of the schedule.

2.—The trader responsible for the loading or unloading of any merchandize other than coal, coke, or patent fuel conveyed or to be conveyed by railway shall load or unload and tender to or place at the disposal of the railway company the wagon employed, together with the covering sheet or sheets, if any, within such time as is specified in the second part of the schedule [not reproduced here].

3.—After the expiration of such time as is specified in the schedule, a railway company may make charges for the detention of any wagon or sheet owned by them, or which for the time being they are entitled to use, or for the use or occupation of any accommodation provided by them in connection with or arising out of the detention of any wagon or sheet.

4.—No trader shall, without the written consent of the railway company, use for internal purposes any wagon or sheet belonging to a railway company, or any wagon or sheet of which the Board of Trade have taken possession under any Orders made in that behalf.

5.—Nothing in this Order shall extend or apply to a wagon belonging to a private owner while the same is upon the private siding or premises of such owner. But save as aforesaid, this Order applies to all railway wagons, whether owned by a railway company or by a private owner. The expression "private owner" includes a person entitled to the use of a wagon under a hiring contract.

6.—In this Order, the term "trader" includes any person sending, or desiring to send, or receiving merchandize by railway, at whose disposal a wagon, whether empty or loaded, is placed.

7.—The provisions of this Order are in addition to, and not in derogation of, any other provisions for enforcing the prompt loading and unloading of wagons.

8.—The Detention of Wagons and Sheets (England and Wales) Order, 1917, is hereby revoked without prejudice to any matter or thing done or suffered, or penalty incurred or proceedings taken thereunder.

9.—Infringements of this Order are summary offences against the Defence of the Realm Regulations.

10.—This Order applies to England and Wales only, and may be cited as "The Railway-Wagons Disposal (England and Wales) Order, 1918."

[A corresponding Order has been made for Scotland.]

SCHEDULE.

PART I.—NUMBER OF DAYS ALLOWED FOR UNLOADING COAL, COKE, AND PATENT FUEL.

At Depôts and in Private Sidings:

In London:

Wagon to be unloaded and placed at railway company's disposal within four days exclusive of the day on which notice of arrival of the wagon is given.

Elsewhere:

Wagon to be unloaded and placed at railway company's disposal within three days exclusive of the day on which notice of arrival of the wagon is given.

When for Barging at London and River Thames Depôts:

Wagon to be unloaded and placed at railway company's disposal within six days exclusive of the day on which notice of arrival of the wagon is given.

If any question arises under this Order, or in any proceedings thereunder, as to whether any depôt or siding is a London depôt or siding, the certificate of the Board of Trade on such question shall be final. In granting such certificate, the Board shall have regard to whether the particular depôt or siding was regarded in the coal trade as situate in London at the date of this Order.

The term "day" means the 24 hours beginning at 6 a.m., excluding the 24 hours beginning at 6 a.m. on Sundays, Good Friday, Christmas Day, and any day declared by or under any Statute or regulations to be a public holiday.

Notice of arrival may be given verbally or in writing, and may be sent by post, telegram, or telephone.

St. Gall Gas Company.—According to the report of the St. Gall Gas Company for the year 1917, the shortage of coal began to be seriously felt in 1916, when stringent measures had to be taken to control the consumption of gas. Also on the side of production recourse was had to wood and peat as substitutes for coal in the retort. But in spite of reduced consumption and the substitution of these materials for coal, the latter became insufficient in quantity to meet the demands. The output of the gas-works fell in 1917 to only 66·2 p.ct.—that is, two-thirds of that of the previous year. Further, it is to be noted that the substitution of wood and peat for coal involves a considerable increase of labour—a circumstance which intensifies the difficulties of production.

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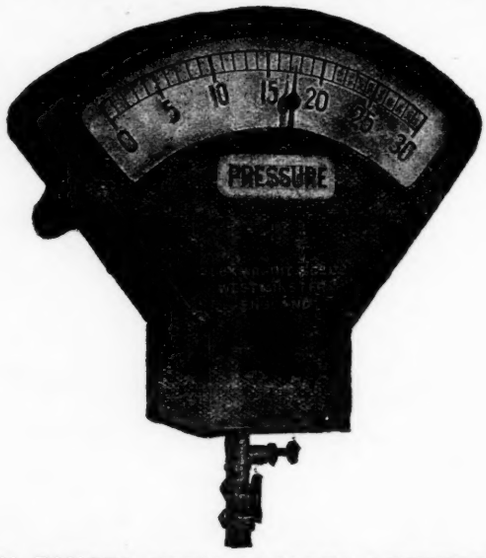

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Gas Plant and all constructional Steel and Iron Work.

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The GAS FIRE that does not look like a GAS FIRE.

A complete GAS FIRE INTERIOR that makes a perfect cover of the existing grate.

Transforms the coal grate interior into a modern gas heating grate having a homely coal fire appearance.

For appearance and effect this type of gas heating grate is unsurpassed.

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WILSONS & MATHIESONS
LIMITED,
Carlton Works,
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of a good MANTLE are embodied in the **Volker**

The ALL BRITISH production of an ALL BRITISH Company

The VOLKER LIGHTING CORPORATION, Ld.
Garratt Lane, ——— LONDON, S.W. 18.

BENZOL AND TOLUOL RECOVERY.

The following letter from Mr. Charles Carpenter, D.Sc., appeared in the "Daily Telegraph" yesterday. Before its publication, a decision regarding the matter had been arrived at by the Ministry of Munitions, as announced in our editorial columns. Mr. Carpenter wrote:

> During the war coal gas has been "stripped" of its volatile hydrocarbons to meet the imperative requirements of explosives manufacture; and among the debts the nation owes to industry, the gas undertakings must not be forgotten for the alacrity with which they responded to the earnest appeal for supplies. Now that an amistice has been signed, I urge that these obligations should be withdrawn forthwith—at any rate, in the case of the Metropolis—so that the maximum amount of heat and light energy can be placed at the disposal of the public through the gas companies' mains.

ELECTRICITY (RESTRICTION OF NEW SUPPLY) ORDER.

The Ministry of Munitions have issued, under date Nov. 8, the following Order:

1.—No person shall on or after the date hereof, except under, and in accordance with, the terms of a permit issued under the authority of the Minister of Munitions:

(*a*) Connect or cause to be connected to any source or means of supply of electricity any place or any building, premises, or plant, or any part thereof, not so connected at the date hereof;

(*b*) Supply or cause to be supplied any electricity to any place or any building, premises, or plant, or any part thereof, not supplied with electricity at the date hereof; or

(*c*) Use or cause to be used any electricity in or at any such place, building, or premises or for the purpose of any such plant as hereinbefore mentioned.

Provided that in any case coming within the scope of the Household Fuel and Lighting Order, 1918, or the Household Fuel and Lighting (Scotland) Order, 1918, as defined by clause 1 of these Orders respectively, where the previous assent of the Local Fuel Overseer is required and has been duly obtained to any fitting, equipment, or supply under clause 99 of the first mentioned Order, or clause 77 of the secondly mentioned Order, no permit hereunder shall be required for such fitting, equipment, or supply or the use of such supply.

2.—All applications with reference to this Order should be addressed to the Director of Electric Power Supply, Ministry of Munitions, No. 8, Northumberland Avenue, W.C.2.

NOTE.—The permission required by the Order is in addition to, and not in lieu of, the usual Priority Certificates and permit reference number.

MAXIMUM PRICES FOR METALLURGICAL COKE.

The Minister of Munitions gives notice, under date Nov. 8, as follows:

1.—On and after July 1, 1918, the Steel Supplies (Metallurgical Coke, Iron, and Steel) Permit, 1916, issued by the Minister of Munitions on Nov. 1, 1916, as modified by the Steel Supplies Permit Amendment No. 5 (Metallurgical Coke), 1917, shall take effect as if in the Steel Supplies Permit Amendment No. 5 (Metallurgical Coke), 1917, the words:

Lancashire, Staffordshire, Yorkshire, Nottinghamshire, Derbyshire, Lincolnshire, Midland Counties.

	Per Ton Net f.o.t. Makers' Ovens.
Blast-furnace coke	£1 12 0
Foundry coke	2 5 0
Steel-melting coke (Sheffield District). . . .	2 14 0

have been substituted therein for the words:—

Lancashire, Staffordshire, Yorkshire, Nottinghamshire, Derbyshire, Lincolnshire, Midland Counties.

Blast-furnace coke	£1 12 0

Provided always that the maximum prices hereby fixed shall not apply to any sale or purchase of any of the materials to which the same relate under a contract in writing entered into prior to July 1, 1918, at a price not contravening that permitted up to that date.

2.—This notice may be cited as the Steel Supplies Permit Amendment (Metallurgical Coke), 1918.

Mrs. Elizabeth Lathom, who was 76 years of age, has died at Crewe from coal-gas poisoning. She was found unconscious in bed with her husband, who was dead; and she died without recovering consciousness. It is believed that the old man, in turning off the gas-jet, accidentally turned it on again.

Changing Over

¶ The Directors of The Davis Gas Stove Co., Ltd., desire to express their sincere appreciation of the patience and courtesy which have been extended to them by British Gas Undertakings throughout the period of the War.

¶ Every effort will now be made by the Company to resume its pre-war standard of prompt and efficient trading service, and to contribute, even more than in the past, to the scientific development of Gas Apparatus manufacture.

THE DAVIS GAS STOVE CO., LTD.,
60, OXFORD ST., LONDON, W. 1.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *Nov.* 18.

Pitch continues in good demand; the price being well maintained at not below 65s. per ton net in bulk at makers' works. The position of creosote, tar oils, and tar spirits is at present unchanged.

Sulphate of ammonia continues in good demand; supplies being readily absorbed as soon as available.

Tar Products in the Provinces.

Nov. 18.

The average values for gas-works products during the week were: Gas-works coal tar, 30s. 6d. to 35s. 6d. Pitch, East Coast, 44s. to 45s. per ton; West Coast—Manchester 37s. 6d. to 40s., Liverpool 37s. 6d. to 40s., Clyde 37s. 6d. to 40s. nominal. Benzol 90 p.ct., North, 10½d. to 11¼d.; 50-90 p.ct., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha in bulk, North, 7¾d. to 8¼d. Solvent Naphtha, naked, North, 2s. 11d. to 3s. Heavy naphtha, North, 2s. 11d. to 3s. Creosote, in bulk, North, 4¼d. Heavy oils, in bulk, North, 5d. Carbolic acid, 60 p.ct. East and West Coasts, 3s. 6d. naked, nominal. Naphthalene, £25 to £30; salts, £6 to £7, bags included. Anthracene, "A" quality, 4d. to 6d. per minimum 40 p.ct.; "B" quality, 1½d. to 2d.

FROM A MARKET CORRESPONDENT.

Tar Products.

It is probably too early to judge the full effect of the armistice upon the markets for tar products; but so far very little change in conditions or prices is to be noted. So many products are under restrictions and regulations; and their release from such conditions must of necessity be a matter of time, although, with the cessation of hostilities, the Government demand must already have come to an end in several instances. Pitch exports still continue to be made under licence, and the system does not improve with acquaintance—in fact, in one or two instances that have come to notice it has caused more trouble and loss than any similar system in connection with any other product hitherto. London prices still continue very firm, and Provincial prices exhibit a tendency to advance further. The French demand is very heavy, and will increase with the cessation of hostilities. There are also good grounds for believing that rather more shipping will be available shortly than has been the case for very many months. Consequently, it is not surprising that those connected with the trade are most optimistic regarding the future. The demand for tar shows no abatement, and is not likely to do so for some months to come. Benzol and toluol are nominal; but there are grounds for looking for an early release from Government control, when prices will be more commensurate with the cost of production. Creosote will likely remain under control for a longer period. Crude 60's carbolic acid is being well taken up at the agreed-upon price of 3s. 6d. per gallon; while crystals are in good demand for export at up to 2s. per lb. Much interest centres in solvent naphtha; but there are surely no grounds for the pessimism regarding the future which prevails in some quarters. There will be a falling-off in the demand from essentially war industries; but there must be a continually increasing demand for peace-time industries, especially in connection with rubber. Heavy and solvent naphtha prices are rather uncertain for the present. Refined naphthalene does not meet with a very heavy inquiry; but the demand for crudes, especially low grades, shows no falling off. Cresylic acid is rather better; but anthracene and aniline oil indicate no change.

The range of quotations is as follows:

Benzol: 90% London, 1s. 0¼d., North 10½d. to 11¼d.; 50% North 1s. 4d. to 1s. 5d. naked per gallon.

Carbolic Acid: 60% East and West Coast 3s. per gallon; crystals 40% 1s. 8d. to 2s. per lb.

Crude Tar: London 39s. to 41s.; Midlands 33s. to 35s.; North 32s. to 34s. per ton *ex* works.

Pitch: London 65s. per ton f.o.b. works; East Coast, 38s. to 42s.; West Coast, 41s. 6d. to 43s. f.a.s.; Manchester, 41s. to 42s.; Clyde, 41s.; South Wales, 45s. to 46s. per ton.

Solvent Naphtha: London 3s. 9d. to 4s.; North and Midlands 3s. 3d. to 3s. 6d. per gallon.

Crude Naphtha: Naked 30% 8¼d. to 8½d.; North 6¼d. to 6½d.

Heavy Naphtha: London 3s. to 3s. 6d.; Provincial 3s. 3d.

Naphthalene: Refined £28 per ton nominal; salts 80s., bags included.

Toluol: Naked, London 2s. 4d.; North 2s. 3d.

Creosote: Nominal, London 4¼d.; North 4d. to 4¼d. (Government price, 75s. per ton f.o.b.—equal to 4½d. per gallon); heavy oil, 4½d. per gallon in bulk.

Anthracene: "A" quality, 40-45%, 4½d. per unit; "B" quality, 1¾d. to 2¼d.

Cresylic Acid: 95%, 3s. per gallon; 97-99%, 3s. 3d. to 3s. 6d. per gallon, casks included, *ex* works London and f.o.b. other ports.

Grease Oils 18° Tw. (naked) £6 per ton f.o.r. makers' works.

Sulphate of Ammonia.

In view of the armistice, the position here becomes most interesting, especially on the export side. The home conditions have not altered, and the demand for agricultural purposes will probably continue to increase. But the requirements for sulphate for munitions purposes must already be on the wane, which means that more sulphate will be available for agricultural purposes and for export. Allied demands will, of course, come first; and already the authorities are releasing the utmost possible compatible with our own requirements. Neutrals would have been willing to pay very high prices lately if they could

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R. & J. DEMPSTER, LTD.,
MANCHESTER.

Temporary London Office
BLENHEIM MANSIONS, BROADWAY, WESTMINSTER, S.W.1.

FIT YOUR NEW PLANT WITH

AS APPLIED TO
GAS HOLDERS · PURIFIERS ·
CONDENSERS · WECKS VALVES ·
WASHER SCRUBBERS · &c. &c.

have obtained delivery; but while the war lasted there was nothing available, even from foreign sources. With the cessation of hostilities, however, they may now stand a chance; and the prices they will pay will considerably raise the average export value. Further afield a very interesting trade phase will present itself; and if we are to recover and maintain our export trade as it existed before the war, the position will require careful watching for some time. The trade we formerly transacted with foreign countries is surely of sufficient importance to justify the closest attention of our manufacturers now.

State Loans and Grants for the Dye Industry.

A memorandum has been issued by the Board of Trade as a White Paper dealing with the scheme for the allocation and administration of the funds provided by Parliament for the development of the dye industry. The primary object of the financial assistance which the Government has decided to give to the dye industry is to ensure that the requirements of the textile and other trades of the United Kingdom and of other parts of the British Empire, which are largely dependent on an efficient supply of dyes, are met within a reasonable period to an extent sufficient to make them independent of German dyestuffs, by placing at their disposal a reasonably sufficient variety of colours of British manufacture and of satisfactory quality. The financial assistance proposed is of two kinds—(*a*) loans, and (*b*) grants-in-aid of (i.) buildings and plant and (ii.) research. Loans will be to assist in the provision of capital, at a commercial rate of interest for the further development of the dye industry, particularly in the direction of the manufacture of those special classes of dyes which are reasonably necessary for dye-users, but are not being manufactured in this country at all, or are manufactured on an insufficient scale, and require for their adequate manufacture in a short time an unduly heavy outlay on plant and equipment. Grants will be of two kinds. First there will be grants-in-aid up to 40 p.c. of the cost of plant and buildings provided mainly for the purpose described—such grants being intended to compensate for the increase in the cost over the normal, and to meet special depreciation and obsolescence due to it, or for other special circumstances due to war conditions. Secondly, there will be grants-in-aid of specialized technical research conducted in connection with the actual manufacture of dyes and advanced intermediates.

The Treasury and Capital Issues.—Notice is officially given that, notwithstanding the signing of the armistice, no relaxation can at present be permitted in the restrictions on capital issues. The approval of the Treasury should still be obtained for all issues of shares, debentures, or other securities, whether for cash or otherwise, for the sub-division or consolidation of shares, and for invitations for deposit loans carrying options, express or implied, to convert into shares or other securities.

Oriental Gas Company, Ltd.

The report for the year ended June 30, which will be submitted by the Directors at the meeting to-morrow, states that, in view of an increasing demand for coal for purposes connected with the prosecution of the war, coupled with an expected shortage owing to reduced output of collieries, the Government of India towards the close of the year 1917 took precautionary measures with the object of safeguarding an adequate supply to meet the prospective necessities of Calcutta in the immediate future. Industrial and commercial undertakings in general were restricted to substantially reduced quantities below their normal requirements. The Company's supply of coal was diminished by 25 p.ct.; and the Municipality of Calcutta were required to put about one-third of the public lamps out of lighting. The Company's sales of gas thus suffered a decrease; but an increase in the returns yielded by the sale of coke, together with the advantage derived from a high rate of exchange upon remittances home, restored the financial position. In result, the balance of revenue account carried to the credit of profit and loss, after allocating £5000 to the renewals suspense account, is £26,415, or £338 more than the corresponding figures of last year. Operations in the nature of extensions and other work properly assignable to capital have been limited by the difficulty, and in some cases the impossibility, of obtaining materials. Such expenditure as has been incurred has been defrayed out of the revenue of the year. The high rate of exchange has produced an increment of £3163 to the equalization account. The Directors have, with great regret, to announce the death of their esteemed colleague, Mr. William Williams, who had been a member of the Board for seventeen years. His ripe experience and extensive knowledge of all the details of gas management were of high value; and the Directors deplore his loss. In conformity with the provisions of the Articles of Association, they have appointed Mr. Bertram Wyburne Ellis, Assoc.M.Inst.C.E., to the seat at the Board thus rendered vacant. The Directors have entered into a contract with the Municipality of Maniktala for the supply of gas to that district for a term of fifteen years. They recommend the payment of a dividend at the rate of 4½ p.ct. (less income-tax), making, with the interim dividend of 3½ p.ct., a total of 8 p.ct. (less tax) for the year.

Ballymena Gas Undertaking.—The report of the audit of the accounts of the Ballymena Gas Department, submitted to the Urban District Council, shows that during the twelve months covered the consumption of coal was 200 tons in excess of that in the previous year, and that there was an increase in gas consumed by private individuals of 460,000 c.ft. The sale of coke shows an increase of £455; and the increase in the total revenue for the year was £672. The cost of manufacture and expenses discloses an increase of £525, apart from the cost of coal. The Clerk said that they were in a better position than last year. The Chairman mentioned they had power to turn off the supply, without notice, in the case of those who were using more than their usual quantity. The report was adopted.

SAWER & PURVES,

THE POSITIVE DRY PREPAYMENT METER

MANCHESTER & NOTTINGHAM.

Bradford Gas-Works Statistics.—A statement issued shows that during the year ended June 30, 181,477 tons of coal were carbonized at the Bradford Corporation Gas-Works; producing 2,009,315,000 c.ft. of gas, 82,787 tons of coke, 11,145 tons of tar, and 22,958 tons of ammoniacal liquor. There has been some extension of mains to munition works, but nothing like the normal amount. The new pipes run to about a mile in length, making a total mileage of 474.

Athlone Gas Undertaking.—At a meeting of the Athlone Town Council, the half-yearly balance-sheet of the gas undertaking was submitted, showing a deficit to Sept. 30 of £351. This took into account the stock of coal on hand, estimated at 450 tons, and valued at £1300; while the period indicated had been charged with a proportion of the cost of setting a new bench of retorts which had not yet been used. The loss on the previous twelve months' working was £1200. The Clerk said the Irish Lighting Restrictions Order would have a serious effect on the current half year. During the past six months they had carbonized 481 tons of coal, giving an average of 9245 c.ft. per ton. The loss of gas in the summer season ran to 40 p.ct. After discussion, it was decided to increase the price from 9s. 3d. to 10s. 10d. per 1000 c.ft., and to abrogate the discount previously allowed on accounts over £100.

Motor Fuel Restrictions.—The Board of Trade, after consultation with the Petroleum Executive, announce that it will not be possible for some time to withdraw entirely the restrictions on the use of petrol for driving motor vehicles. The Petroleum Executive are making arrangements to provide as quickly as possible increased supplies of petrol to be distributed by the Petrol Control Department for civilian purposes. In the meantime, having in view the greater facilities which will be available for increasing the petrol stocks later on, the Board of Trade will be able to some extent to relax the provisions of the Motor Spirit (Consolidation) and Gas Restriction Order, 1918. On Dec. 1 the Order will be modified to permit the use of motor spirit by licence-holders for driving motor vehicles of any type for all purposes within a radius of 30 miles of the place of residence or business of the licence-holder. So far as journeys beyond this radius are concerned, the restrictions will remain in force, but will be removed entirely as soon as possible. Then on Jan. 1, if the condition of the stocks of motor spirit permits, the Petrol Control Department will be prepared to consider applications from owners of commercial and public utility vehicles for an increase in their present allotments. Applications for licences will also be considered from owners of vehicles of this type who do not at present hold licences.

STOCK MARKET REPORT.

THE Stock Exchange has undergone a rather remarkable reaction, even in these days of quick change. From the pinnacle of elation of a week ago it has suddenly been plunged into the depths of depression. Views differ as to what may have been the cause—perhaps there were more than one, and certainly there is a good deal of anxiety as to the issue of the tremendous problems awaiting Peace reconstruction. Meanwhile, there was a pretty general move to realize wherever a profit was visible, and to limit commitments. In the result, markets from the highest rank downwards were flat.

The gilt-edged suffered as much as any. Home Government issues began to give way on Tuesday; and each succeeding day War Loans and Consols were lower. Home Rails followed the same line, and closed at their lowest, and Argentines did no better.

Business in the Gas Market was much quieter than in the week before; but—in accordance with the experience of the past, which shows that this market can sometimes take a line of its own apart from the rest—the general tendency was favourable; and most of the changes in value were in the upward direction. Gas Light and Coke and South Metropolitan were the exceptions; but their ordinary stocks receded only one point. In Suburbans and Provincials, Brentford, Brighton and Hove, Southampton, and Tottenham had rises, and Wandsworths changed hands at improving figures. Imperial Continental reached 131½, and Cape Town, Primitiva, and South Africa advanced.

Bargains done for cash during the week were as follows: On Monday, Commercial 3½ p.ct. 62½, Continental Union 51½, Gas Light ordinary 74, ditto preference 69, Imperial Continental 128, 128¼, 129½, 130, 130½, 131, 131⅛, Primitiva 47s. 6d., ditto preference 73s. 6d., 75s., South Metropolitan 75½, 76, 76¼, Wandsworth "A" 87, ditto "B" 67, ditto debenture 49, Redhill 66½. On Tuesday, Bombay 5⅛, British 31, Continental Union 51, Gas Light ordinary 72¾, 73, Imperial Continental 128, 128½, 129, 129¼, 130, Monte Video 9⅛, 9⅜, Primitiva preference 72s. 6d., 75s., South Metropolitan 75, 75½, 76. On Wednesday, British 31⅛, Cape Town debenture 62, Commercial 3½ p.ct. 62½, Gas Light ordinary 72⅝, 73¼, 73½, 73⅝, ditto preference 68½, Monte Video 9⅜, 9¼, Ottoman 4¾, Primitiva 47s. 3d., 47s. 6d., 48s., ditto preference 75s., 76s. 3d., South Metropolitan 75, ditto debenture 55½, Tottenham "B" 67¼. On Thursday, Brighton and Hove original 142, Cape Town debenture 62½, Continental Union 51, Gas Light ordinary 72¼, 72½, 73, 73½, Imperial Continental 128, 128½, 128⅝, 129, 129½, 130, Lea Bridge 95, 95½, Monte Video 9¼, Primitiva 46s. 3d., ditto preference 74s. 3d., 74s. 4½d., South Metropolitan 75, ditto debenture 56½, Wandsworth "A" 92⅞, ditto Wimbledon 72½. On Friday, Brentford "B" 71¾, 72, Gas Light ordinary 72, 72⅜, Imperial Continental 127, 128, 128½, Primitiva 45s., 45s. 6d., 47s. 6d., South Metropolitan 74, 74½, 75, 75½, South Suburban 71½, Wandsworth "B" 74, ditto Wimbledon 72½.

In the Money Market, there was a fair demand most of the week, but it slackened off towards the close. The Bank rate is 5 p.ct., as fixed on April 5, 1917.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue. £	Share.	When last Dividend.	Ante-War Dividend & Bonus p.c.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
182,049	Stk.	Mar. 10	4	4%	Aldershot 4 p.c. Pref.	..	55—60	..
1,551,868	"	April 8	2½	4⅜%	Alliance & Dublin Ord.	59—64	51—56	..
874,000	"	July 10	4	4%	Do. 4 p.c. Deb.	76—79	62—67	..
280,000	5	April 29	7½	8%	Bombay, Ltd.	5⅞—6⅜	5⅛—5⅜	5½
50,000	10	Feb. 26	16	11⅛%	Bournemouth Gas and Water { 10 p.c.	29—30	21—23	..
333,110	10	"	7	7%	Bournemouth Gas and Water { B 7 p.c.	15—15½	10—11	..
115,000	10	"	6	6%	Bournemouth Gas and Water { Pref. 6 p.c.	13½—14	9—9½	..
159,740	—	—	—	4%	Bournemouth Gas and Water { 4 p.c. Deb.	..	66—68	..
992,045	Stk.	Feb. 26	14	11⅛%	Brentford A Consolid.	261—266	78—81	..
784,920	"	"	11	11%	Do. B New	204—209	70—73	71½—72
55,000	"	"	5	5%	Do. 5 p.c. Pref.	109—111	77—82	..
221,400	"	June 11	4	4%	Do. 4 p.c. Deb.	91—93	63—65	..
317,880	"	Feb. 26	11	8⅛%	Brighton & Hove Orig.	208—213	138—143	142
244,200	"	"	8	5⅝%	Do. A Ord. Stk.	154—159	95—100	..
530,000	20	Mar. 26	12½	22/6	British	44—45	31—32	31—31½
120,000	Stk.	June 26	4	4%	Do. 4 p.c. Deb. Stk.	88—90	64—66	..
245,771	"	"	4	4%	Buenos Aires 4 p.c. Deb.	85—87	51—54	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	3⅜—4½	..
100,000	10	—	—	4⅛%	Do. 4½ p.c. Pref.	4—6	7½—8½	..
100,000	Stk.	June 26	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	60—65	62—62½
157,150	"	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	79—81	..
1,518,280	"	Feb. 12	5/9/4	36/-	Commercial 4 p.c. Stk.	106—108	62—67	..
580,000	"	"	5⅛	80/-	Do. 8½ p.c. do.	103—105	58—63	63½
475,000	"	June 11	8	8%	Do. 8 p.c. Deb. Stk.	69½—71½	52—54	..
800,000	"	"	4	—	Continental Union Ltd.	76—79	50—55	51—51½
200,000	"	"	7	—	Do. 7 p.c. Pref.	115—118	70—75	..
278,400	—	—	—	10½%	Croydon B and C 7 p.c.	..	140—150	..
—	—	—	—	10%	Do. E	..	..	..
499,270	Stk.	—	6	5½%	Derby Con. Stk.	128—135	95—100	..
55,000	"	—	4	4%	Do. Deb. Stk.	102—104	80—83	..
1,002,180	10	July 29	10	5/0	European, Ltd.	17½—18	13—14	..
16,298,975	Stk.	Feb. 10	4/17/4	29/4	Gas Light and Coke { 4 p.c. Ord.	98—102	72—74	72—74
2,600,000	"	"	8½	8½%	Gas Light and Coke { 8½ p.c. max.	76—79	54—56	..
4,063,235	"	"	4	4%	Gas Light and Coke { 4 p.c. Con. Pref.	96—99	67—69	68½—69
4,674,850	"	June 11	8	8%	Gas Light and Coke { 8 p.c. Con. Deb.	72½—74½	55—57	..
180,000	"	"	10	10%	Gas Light and Coke { 10 p.c. Bonds	..	..	..
268,740	"	Mar. 12	5	3⅜%	Hastings & St. L. 8½ p.c.	87—89	45—50	..
70,000	10	April 29	11	6%	Hongkong & China, Ltd.	16½—16⅞	7—8	..
66,600	—	—	—	9½%	Hornsey 7 p.c.	..	112—117	..
181,000	Stk.	Mar. 12	7⅞	6¼%	Ilford A and C	151—154	92—97	..
65,780	"	"	6⅜	4⅜%	Do. B	115—118	70—75	..
65,500	"	June 26	4	4%	Do. 4 p.c. Deb.	92—94	62—65	..
4,940,000	"	May 14	9	4½%	Imperial Continental	150—160	127—132	127—131½
1,235,000	"	Feb. 12	8½	8½%	Do. 8½ p.c. Deb. Red.	84—86	71—73	72
235,242	"	Mar. 12	6½	6½%	Lea Bridge Ord. 5 p.c.	119—121	93—98	95—95½
2,498,905	"	Feb. 26	10	5%	Liverpool 5 p.c. Ord. { A B	211—213 146—148	82—84	..
806,088	"	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	..	71—78	..
75,000	5	June 11	6	3%	Malta & Mediterranean	4½—4⅝	3½—3¾	..
250,000	100	April 1	4½	4½%	Met. of Melbourne { 4½ p.c. Deb.	99—101	87—98	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11⅜—12	8⅜—9½	9¼—9½
1,875,892	Stk.	July 29	4½	8½%	Newcastle&Gatsh'd Con.	98½—99½	70—70½	..
529,705	"	June 26	8½	8½%	Do. 8½ p.c. Deb.	82—88	59—61	..
55,940	10	Feb. 26	7/14/0	7½	North Middlesex 7 p.c.	14—15	9½—10½	..
300,000	Stk.	May 14	8	8%	Oriental, Ltd.	117—122	103—105	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7⅝	4—5	4⅜
60,000	50	Feb. 26	13	9%	Portsea, Island B	128—131	78—83	..
100,000	50	"	12	8%	Do. C	118—121	73—78	..
53,000	50	"	10	6%	Do. D	..	..	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	2½—2½	45/—48/-
499,960	5	June 26	5	2/6	Do. 5 p.c. Pref.	4⅜—5	3⅜—3¾	73/6—76/8
521,600	100	June 2	4	4%	Do. 4 p.c. Deb.	91—98	75—77	..
—	—	—	—	4%	Do. " " 1911	..	50—55	..
346,198	Stk.	June 26	4	4%	River Plate 4 p.c. Deb.	86—87	55—60	..
150,000	10	May 14	6	6/-	San Paulo { 6 p.c. Pref.	10½—11	7½—8	..
125,000	50	July 1	5	5%	San Paulo { 5 p.c. Deb.	47—49	40—42	..
135,000	Stk.	Mar. 12	10	10%	Sheffield A	228—234	170—173	..
209,984	"	"	10	10%	Do. B	232—234	170—173	..
523,500	"	"	10	10%	Do. C	230—232	168—172	..
90,000	10	May 28	9	6/-	South African	10½—11½	12—13	..
6,609,895	Stk.	Feb. 10	5/4/0	32/-	South Met. 4 p.c. Ord.	111—113	74—76	74—76½
250,000	"	July 12	—	5%	Do. Pref.	..	91—98	..
1,895,445	"	July 10	8	8%	Do. 3 p.c. Deb.	73½—74½	55—57	55½—56½
224,820	"	Feb. 26	8½	6%	South Shields Con. Stk.	157—159	118—119	..
952,795	"	"	6	3½%	S'th Suburb'n Ord. 5 p.c.	114—116	71—74	71½
60,000	"	"	5	5%	Do. 5 p.c. Pref.	110—112	75—78	..
185,000	—	—	—	8½%	Do. West Kent	..	..	..
187,558	Stk.	June 26	5	5%	Do. 5 p.c. Deb. Stk.	116—118	85—87	..
647,740	"	May 14	5	3%	Southampton Ord.	99—102	67—70*	..
120,000	"	Feb. 12	7½	5⅝%	Tottenham District { A 5 p.c.	135—138	92—97	..
782,275	"	"	6	4%	Tottenham District { B 3½ p.c.	115—117	67—69	67½
181,255	"	June 26	4	4%	Tottenham District { 4 p.c. Deb.	87—89	62—64	..
182,880	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	..
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	45—50	..
236,476	Stk.	Mar. 12	5	5%	Tynemouth 5 p.c. max.	103½—109½	87—88	..
80,000	"	Feb. 26	8⅜	68/9	Wandsworth, Wimbledon, and Epsom—Wandsworth A 5 p.c.	151—156	90—95	87—92⅞
255,636	"	"	6¾	48/9	Do. B 3½ p.c.	129—134	70—75	67—74
108,075	"	"	5/17/3	44/7½	Do. C 3½ p.c.	110—115	70—78	..
852,000	"	"	6¼	42/6	Wimbledon 5 p.c.	117—122	70—75	72½
98,000	"	"	6⅞	48/9	Epsom 5 p.c.	121—126	72—77	..
88,416	"	June 26	8	8%	3 p.c. Deb. Stk.	68—69	49—52	49

* *Ex div.*

Dublin Gas Workers.—The wages dispute between the Alliance and Dublin Consumers' Gas Company and those of their employees who are members of the Irish Transport Workers' Union has been amicably settled.

Compressed Gas for Traction Purposes.—The "Chemiker Zeitung" says that the Danish coal-rationing authorities have allowed 325 tons of coal a month free for the production of compressed gas for driving some 200 heavy road motor-vans, according to an original Norwegian invention.

Government Control in Switzerland.—It was announced in a recent issue of the "Journal für Gasbeleuchtung" that the Swiss Bundesrat have passed a measure for the protection of the gas industry of the country. With a view to securing at all times a sufficient and satisfactory supply of gas, its manufacture, distribution, and price, as well as the provision of the necessary raw materials and the use of bye-products, have been put under the control of a Government Department. The measure is expected to promote economy both in the manufacture and the consumption of gas.

Celebrating the Armistice at Granton.—The signing of the armistice was celebrated at the Granton Gas-Works of the Edinburgh and Leith Commissioners by illuminating flares arranged around the top tier of guide-frame girders—two flares between each finial, thus composing a coronet of flares. The position of the holder-framing, on the banks of the Forth, makes it a conspicuous feature in the landscape, as well as being situated about mid-way between the outer protection works of the estuary, and the Rosyth base of the Grand Fleet.

More Gas at Malton.—A soldier home on leave, who was formerly a gas stoker, came to the rescue last week at Malton and Norton (Yorks), where the output of gas had been so limited through the effect of the influenza epidemic on the workers, that the district had to be in darkness for the greater part of the nights. The soldier did such good work that, with no services in the churches on the Sunday evening, modified lighting in the houses became possible. The Council decided to make efforts to get an extension of the man's leave. The failure of the gas affected the water supply at Norton; and at one time a rather serious situation arose at the Highfield Military Hospital.

Irish Lighting Restrictions.—A revised Irish Lighting Restrictions Order was issued by the Viceroy (Lord French) last week. It provides for the closing of retail shops in Dublin, Belfast, Londonderry, Cork, Limerick, and Waterford, and offices connected with them, not later than 5.30 p.m. on the first four days of the week, 7 p.m. on Fridays, and 9.30 p.m. on Saturdays. Exceptions are made in favour of premises for temperance refreshments, hairdressing, tobacco sales, and newsvending, which are allowed opening on all evenings up to 9.30. Shops for the sale of food, fruit, and sweets must close from 3.30 to 6, but may open from 6 to 9.30. Hotels, restaurants, and railway refreshment rooms may open between 3.30 and 6 for meals, but not for the service of intoxicants; and general licensed premises must close between those hours. For the smaller towns, 7 o'clock closing is provided for, with 9.30 on Saturdays; wholesale houses closing every day at 5.30. Picture-houses must close between 3.30 and 5.30; and all places of entertainment must finish at 10.30. No light is to be used while premises are shut, except for half-an-hour after closing time.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

GAS ENGINEER AND MANAGER. Droitwich Corporation. Applications by Nov. 30.
MANAGER (Coke Oven and Bye Products Works). No. 6530.
WORKS SUPERINTENDENT. Rochester, Chatham, and Gillingham Gas Company. Applications by Nov. 28.
ASSISTANT SECRETARY. No. 6529.
CHEMIST. Bath Gas Company.
RETORT HOUSE MEN. Peterborough Gas Company.
JUNIOR ASSISTANT CHEMIST. No. 6527.
JUNIOR WORKS ASSISTANT. No. 6519.
CARBONIZING FOREMAN. Barnet Gas and Water Company.
TINSMITHS. Gas Meter Company.
STOKER. Merthyr Vale Gas-Works.
STOKERS. Yeovil Gas-Works.

Appointments, &c., Wanted.

COMPANY COLLECTOR. No. 6531.
ENTIRE MANAGEMENT OF MEDIUM SIZED GAS-WORKS, No. 6526.

Plant, &c., for Sale.

ANNEALING MUFFLE (GAS). Charles Joyner and Co., Ltd., Birmingham.
BIGGS-WALL HAND CHARGING MACHINE. Clevedon Gas-Works.
ENGINE AND PUMP. Clevedon Water Company.
IRON SHEETS. Erector, Leeds.

Cancellation of Registry.

GAS MANTLE ASSOCIATION, LIMITED.

TENDERS FOR.

Coal

NOTTINGHAM CORPORATION. Tenders by Nov. 28.

General Stores (Picks, Shovels, Bricks, Ironmongery, Castings, &c.)

NOTTINGHAM CORPORATION. Tenders by Nov. 28.

Tar, Pitch, and Creosote Oil.

NOTTINGHAM CORPORATION. Tenders by Nov. 28.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders to Alter or stop PERMANENT ADVERTISEMENTS should be received by the FIRST POST on Saturday.

Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

United Kingdom: One Year, 23s. 6d.; Half Year, 12s.; Quarter, 6s. 6d.
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In payment of subscriptions for "JOURNALS" sent abroad, Post Office Orders or Bankers' Drafts on London only are accepted.

All Communications, Remittances, &c., to be addressed to
WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C. 4.

Telegrams: "GASKING, FLEET LONDON." Telephone: Holborn 6857.

OXIDE OF IRON
FOR SALE OUTRIGHT, OR ON LOAN.

SPENT OXIDE
PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LTD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C. 2.

"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for Gas-Works.
ANDREW STEPHENSON, Gresham House, Old Broad Street, LONDON, E.C. "Volcanism, London."

TAR AND GAS LIQUOR WANTED
IN LONDON DISTRICT.

THOMAS CLAYTON (Oldbury), Ltd.,
BRENTFORD, W.
Telegrams: Canal, Brentford. 'Phone: Ealing 17.

"FERROX." "FERROX." "FERROX."
A BRITISH Oxide Cheaper and Better than Bog Ore. 35 per cent. Water, 75 per cent. Ferric Hydrate.
For Sale outright or on Loan.
OXIDE LIMITED, Brentford, MIDDLESEX.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, LONDON, S.E. 1.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 815 Oldham, and 2412 Hop, London.
Telegrams—
"BRADDOCK, OLDHAM," and "METRIQUE, LAMB, LONDON."

BENZOL PLANTS FOR GAS-WORKS.

BAGLEY, MILLS, & CO., Ltd.,
92, Victoria Street, Westminster, S.W. 1, Invite inquiries from all Gas-Works making 75 million cubic feet and upwards per annum.

ALDER AND MACKAY, LTD.
(ESTABLISHED 1850).
WET AND DRY METERS,
SLOT AND ORDINARY.
STREET LAMPS AND AUTOMATIC CONTROLLERS.
EDINBURGH.
(See p. 440.)

SPENCER'S Patent Inclined HURDLE GRIDS.

THE very best Patent Grids for Holding Oxide Lightly.
See Illustrated Advertisement, p. 401.

OXIDE OF IRON.
SPENT OXIDE WANTED.
BALE & CHURCH, LTD.
33, ST. MARY AT HILL, LONDON, E.C. 3.
Phone: Avenue 6680.

"TORTO" FIRE CEMENT.
BALE & CHURCH, LTD.
33, ST. MARY AT HILL, LONDON, E.C. 3.
Phone: Avenue 6680.

"KLEENOFF," THE COOKER CLEANSER.
Tins for Sale to Consumers.
In Bulk for Works Use.
BALE & CHURCH, LTD.
33, ST. MARY AT HILL, LONDON, E.C. 3.
Phone: Avenue 6680.

SULPHATE OF AMMONIA
SATURATORS and all LEAD and TIMBER WORK in connection with Sulphate Plants.
We Guarantee promptness with efficiency for Repairs.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.
Telegrams—"SATURATORS, BOLTON." Telephone 0848.

MEWBURN, ELLIS, AND PRYOR.
CHARTERED PATENT AGENTS AND TRADE MARK AGENTS,
70, Chancery Lane, London.
Telegrams: "Patent, London." 'Phone: 243 Holborn.
And 3, St. Nicholas Buildings, Newcastle-on-Tyne.

ROBERT DEMPSTER & SONS, Ltd., Contractors for Complete CARBONIZING PLANTS and every Description of GAS APPARATUS, ELEVATING, CONVEYING, and TELPHERAGE PLANTS, also STOKING MACHINERY, ROSE MOUNT IRONWORKS, ELLAND.

BRITISH GAS PURIFYING MATERIAL.

ENGLISH BOG ORE AND NATURAL HYDRATED OXIDE OF IRON.
SPENT OXIDE BOUGHT.

BRITISH GAS PURIFYING MATERIALS CO., LTD.

(W. T. P. CUNNINGHAM, Chief Proprietor and Managing Director.)

13, ARCADIAN GARDENS, WOOD GREEN, LONDON, N. 22.
Telegrams: "Bripurimat, Wood, London."
'Phone: Palmer's Green 608.

SULPHURIC ACID.

SPECIALLY prepared for the manufacture of SULPHATE OF AMMONIA.

SPENCER CHAPMAN & MESSEL, LTD., with which is amalgamated WM. PEARCE & SONS, LTD., Mark Lane, LONDON, E.C. Works—SILVERTOWN.
Telegrams—"HYDROCHLORIC, FEN, LONDON."
Telephone—1588 AVENUE (3 lines).

SEND your inquiries for Carburetted HYDROGEN AND BLUE WATER-GAS PLANT, also TAR DEHYDRATING PLANT and other GAS-WORKS APPARATUS to—

BALE AND HARDY,
89, VICTORIA STREET, WESTMINSTER, S.W. 1.

J. E. C. LORD, Ship Canal Tar-Works, Weaste, Manchester. Pitch, Creosote, Benzols, Toluol, Naphtha, Pyridine, all kinds of Cresylic Acid, Carbolic Acid, Sulphate of Ammonia &c.

GAS-WORKS requiring Extensions should Communicate with FIRTH BLAKELEY, SONS, AND CO., LIMITED, Dewsbury, who make a Speciality of Catering for the Smaller Gas Concerns. Prices Reasonable; quality and results, the best. Satisfaction Guaranteed.

EXPERIENCED Gas Engineer and MANAGER desires CHANGE OF APPOINTMENT. First-Class References. Would prefer medium-sized Works with Entire Business Management.
Address No. 6526, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C. 4.

COMPANY Collector—Ex N.C.O., permanently discharged—seeks Position as COMPANY COLLECTOR to medium-sized Company. Thoroughly acquainted with Accounts and Gas Company's Business generally. Age 25. Salary required £132 per Annum. Disengaged Dec. 1.
Address, No. 6531, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C. 4.

BOROUGH OF DROITWICH.

WANTED — a Competent Gas Engineer and MANAGER to Take Charge of the Corporation Gas-Works, Public Lamps, Mains, Services, Machinery, and Meters.
He must have a Practical Knowledge of the Manufacture of Gas on Regenerative Principles, Sulphate of Ammonia, and all Residuals, and be able to keep all necessary Books.
Commencing Salary, £250 a Year.
Applicant must state earliest date when he can enter on his duties, if elected, and must send in Application in his own Handwriting, marked "Gas Engineer and Manager," stating Age and Experience, accompanied by *copies* of Three Testimonials of recent date (which may be typed, but which will not be returned), to the undersigned, on or before the 30th inst.
Canvassing a Disqualification.

S. JOHN TOMBS,
Town Clerk.

Town Hall,
Droitwich,
Nov. 11, 1918.

ROCHESTER, CHATHAM, AND GILLINGHAM GAS COMPANY.

APPLICATIONS are invited for the Position of WORKS SUPERINTENDENT of the Company's Gillingham Station. Salary, £250 per Annum, with House, Rates, Taxes, Coal, and Gas free.
Applicants must have had good Experience in the working of Continuous Vertical Retorts, Carburetted Water-Gas Plant, and be capable of Preparing Drawings.
Applications, accompanied by *copies* of not more than Three recent Testimonials, to be sent to the undersigned, endorsed "Superintendent," not later than Nov. 28, 1918.

C. VALON BENNETT,
Engineer and General Manager.

Gas Offices,
95, High Street,
Rochester.
Nov. 15, 1918.

WANTED, for a large Coke-Oven and Bye-Product Plant, a COMPETENT MANAGER, capable of Taking Entire Charge. Must be a Good Organizer and used to Handling Men. Liberal Salary to Suitable Applicant.
Apply, by letter, giving full Particulars as to Qualifications, Experience, Age, and Salary required, to No. 6530, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C. 4.

BATH GAS LIGHT AND COKE COMPANY.

CHEMIST.

WANTED — A Fully-Qualified CHEMIST.
Applications, stating Age and Salary required, together with *Copies* of Testimonials, to be addressed to the undersigned,

J. WESLEY WRIMSTER,
Engineer and Manager.

GAS Company requires Assistant SECRETARY. Must have Experience in Book-keeping and General Gas Office Routine.
Apply, by letter, stating Age, Experience, and Salary required, to No. 6529, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C. 4.

WANTED—Junior Assistant Chemist for Tar-Works Laboratory, to do Eight-Hour Shift Work in Metropolitan Area. Wages, £2 per Week, *plus* 23s. 6d. War Bonus.
Apply, by letter, to No. 6527, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C. 4.

JUNIOR Works Assistant required for 250 Million Works. Knowledge of Drawing. Chemistry, and usual Works Routine Testing required. Salary, £150.
Apply, giving full Particulars, to No. 6519, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C. 4.

CARBONIZING Foreman required at once. Good Capable Man, Experienced with Machine Stoking. Twelve-Hour Shifts. Wages, 75s. per Week.
Apply, giving Experience and Training, to F. J. BANCROFT, Barnet District Gas and Water Company, NEW BARNET.

WANTED—Tinsmiths for Gas Meter Work.
Apply, GAS METER COMPANY, 238, KINGSLAND ROAD, E. 2.

PETERBOROUGH GAS COMPANY.

RETORT-HOUSE Men Wanted. "F.A." Machine and Hot Coke Conveyor Installed.
Apply to the MANAGER, Gas-Works, PETERBOROUGH.

GAS-WORKS, MERTHYR VALE.

WANTED—a Reliable Man (Ineligible for Military Service) as GAS STOKER. Must be good Shovel Charger and understand Regenerator Furnaces, Engine, and Exhauster.
Apply, stating Age and Experience, to Mr. W. MILLAR, Nixon's Navigation Offices, MOUNTAIN ASH.

TWO Gas Stokers wanted (Scoop Charging). Wages, £3 1s. 2d. per Week—One Full Day's Holiday each Fortnight, with Pay.
Apply to GEO. FENWICK, Manager, Gas-Works, YEOVIL.

SET of Condensers required to deal with Three Quarters of a Million Feet of Gas per Day. Slightly smaller might suit.
State Price on Rails or where they stand to No. 6524, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C. 4.

ANNEALING Muffle, Gas, Automatic, by John Wright & Co., 20 ft. long, with openings 18 in. by 18 in. Excellent Condition, Suitable for Accurate Annealing Pressings, Stampings, or Strip Metal.
CHARLES JOYNER & CO., LTD., Icknield Square, BIRMINGHAM.

FOR SALE—Worthington Horizontal Compound Condensing PUMPING ENGINE, 20,000 Gallons per Hour, 8-in. Connections, in Perfect Condition; also Worthington Duplex BOILER FEED PUMP, 2-in. Suction, 1½-in. Delivery.
CLEVEDON WATER COMPANY, Moor Lane, CLEVEDON.

FOR SALE — Biggs-Wall "Rapid" HAND-CHARGING MACHINE, with Scoops and Double Scoop Carriages.
For Particulars, apply to J. HARGER PYE, Gas-Works, CLEVEDON.

FOR SALE.—New Faultless Corrugated IRON SHEETS in 5 ft. 6 in., 7 ft., 8 ft., 9 ft., and 10 ft. Lengths. Gauges, 24, 22, 20; also 6 ft., 7 ft., 8 ft. Lengths, 18 Gauge. All Sheets are 32 in. wide and Painted Red Oxide, ready for Fixing.
Apply, ERECTOR, 171, WOODHOUSE LANE, LEEDS.

CAST-IRON Gas-Mains, 4 in., 5 in., and 6 in. Socket and Spigot, in 9 ft. lengths, ready for Delivery.
FIRTH BLAKELEY, SONS, & CO., LTD., CHURCH FENTON, *via* LEEDS.

STEEL Storage Tank, about 330,000 Gallons Capacity. Splendid Condition. Ready for Removal and Erection.
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GAS PLANT for Sale.—We can always offer New and Second-Hand Gas Apparatus, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
FIRTH BLAKELEY, SONS, AND CO., LTD., CHURCH FENTON, near LEEDS.

GASHOLDERS FOR SALE. — Ready for Removal.
Double-Lift GASHOLDER, 60 ft. and 58 ft. dia. by 18 ft. deep. Capacity, 95,000 c. ft., with STEEL TANK.
GASHOLDER, 42 ft. dia. by 16 ft. deep. Capacity, 23,000 c. ft., with STEEL TANK.
GASHOLDER, 30 ft. dia. by 10 ft. deep. Capacity, 7000 c. ft., with STEEL TANK.
GASHOLDER, 30 ft. dia. by 14 ft. deep. Capacity, 10,000 c. ft., for erection in Brick Tank.
GASHOLDER, 35 ft. dia. by 12 ft. deep. Capacity, 12,000 c. ft., for erection in Brick Tank.
These Holders are in First-Class Condition.
FIRTH BLAKELEY, SONS, & CO., LTD., CHURCH FENTON, *via* LEEDS.

CITY OF NOTTINGHAM.

THE Works and Ways Committee are prepared to receive TENDERS for the Supply of the undermentioned STORES and MATERIALS; the Contracts to commence on the 1st of January next, and to terminate on the 31st of December, 1919:—

(A) CEMENT.
(B) BLUE LIAS LIME.
(C) RED BRICKS.
(D) BLUE BRICKS.
(E) TIMBER.
(F) STONEWARE PIPES, &c.
(G) STONEWARE PIPES, &c. (Patent Joints).
(H) IRON CASTINGS, IRON GULLEYS, &c.
(I) YORKSHIRE FLAGS, KERB, &c.
(J) GRANITE SETTS, KERB, and BROKEN GRANITE.
(K) IRONSTONE SLAG, CHIPPINGS, &c.
(L) RIVER GRAVEL.
(M) COAL.
(N) PICKS, SHOVELS, SCOOPS, &c.
(O) IRONMONGERY.
(P) SCAVENGING and other BRUSHES.
(Q) DISINFECTANTS.
(R) REFINED TAR.
(S) PITCH.
(T) CREOSOTE OIL.

Forms of Tender may be obtained on applying to Mr. Arthur Brown, M.Inst.C.E., City Engineer, Guildhall, Nottingham, on payment of a deposit of 5s. each, which will be returned on receipt of a *bona-fide* Tender, in accordance with the Specifications, providing such Tender is not withdrawn, and is Delivered by the time stated below.
Patterns and Samples may be inspected at the Eastcroft Depôt, London Road, Nottingham.
The Committee will not consider any Tender except on the authorized Form of Tender, which must be Delivered to the undersigned, in the Official Envelope provided, on or before Thursday, 28th of November, 1918.
The lowest or any Tender will not necessarily be accepted, and Tenders will only be accepted from persons who conform to the Conditions as regards paying the Local Standard Rate of Wages, &c., and to the working rules of the Nottingham District applicable to the various trades.

By order,
W. J. BOARD,
Town Clerk.

Guildhall,
Nottingham,
Nov. 2, 1918.

ADVERTISEMENT OF CANCELLING.

GAS MANTLE ASSOCIATION, LIMITED.

NOTICE is Hereby Given that the Registrar of Friendly Societies has, pursuant to the Industrial and Provident Societies Act, 1893, this day CANCELLED the REGISTRY of the Gas Mantle Association, Limited (Reg. No. 5993 R), held at c/o E. N. Beningfield, Friars House, 39-41, New Broad Street, E.C. 2, in the County of London, on the ground that the Society has wilfully, and after notice from me, violated the provisions of the said Act in having failed to furnish the Annual Return of the said Society for the year 1916.
The Society (subject to the right of appeal given by the said Act) ceases to enjoy the privileges of a registered Society, but without prejudice to any liability incurred by the Society, which may be enforced against it as if such cancelling had not taken place.
Dated the 12th day of November, 1918.

G. STUART ROBERTSON,
Chief Registrar.

PATENTS — Inventors, Advice, and Handbook Free.
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